F.A.A. APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

IN

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This supplement must be attached to the FAA Approved Airplane Flight Manual when the airplane is modified by the installation of a single Honeywell FMZ-800 Flight Management System with GPS Sensor Units allowing for Non-Precision Approaches in accordance with STC ST00067DE.

The information contained herein supplements or supersedes the basic manual only in those areas listed herein. For limitations, procedures, and performance information not contained in this supplement, consult the appropriate basic Airplane Flight Manual if applicable.

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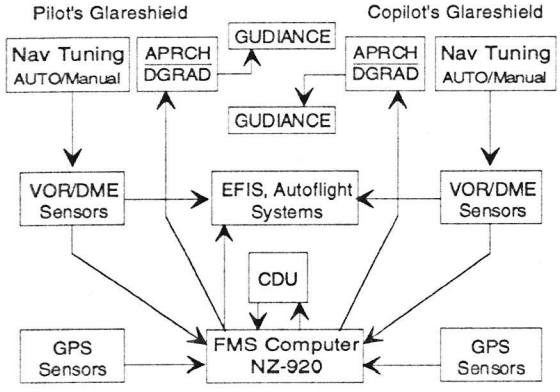
SECTION I - GENERAL

INTRODUCTION

This AFM Supplement describes the installation, operating instructions and limitations of a single Honeywell FMZ-800 Flight Management System with GPS Sensor Units allowing for Non-Precision Approaches. The limitations are based on guidance from FAA Notice 8110.48 (4/23/93) *"Airworthiness Approval Of Navigation Or Flight Management Systems Integrating Multiple Navigation Sensors,"* and FAA flight evaluations. A lengthy sub-section to the Normal Procedures section of this document titled "FMS Functions and Operations" is included to supplement the Honeywell FMS Pilots Manual. A brief discussion of GPS approach navigation and integrity is included to aid the aircrew's understanding of GPS approach methodology, limitations, and annunciations.

SYSTEM DESCRIPTION

The Honeywell FMZ-800 Flight Management System (FMS) consists of an NZ-920 Navigation Computer, a CD-810 Control Display Unit, one or two Global Positioning System Sensor Units (GPSSU), GPS antennas, and a DL-800 carry on data loader. The system also interfaces to existing NAV receivers and DME transceivers. The FMZ-800 interfaces to the SPZ-6000 digital avionics system through the Avionics Standard Communications Bus (ASCB). Located in the pilot's and copilot's glareshield are navigation tuning switches, "GUIDANCE" and "APRCH/DGRAD" annunciators. The simplified block diagram depicts the Flight Management System's major components. The FMS/GPS system is considered a single system for navigation redundancy requirements even if the optional second GPS sensor is installed.



FMS/GPS Simplified Block Diagram

Lateral navigation through the FMS is normally calculated with inputs from scanning DME (DME/DME navigation), VOR bearing and DME distance (VOR/DME navigation) or from GPS sensor(s). If no position is available from these sensors, the FMS will utilize heading information from the Attitude Heading Reference System (AHRS) and True Airspeed (TAS) from the Digital Air Data Computer (DADC) to navigate in the Dead Reckoning (DR) mode.

Display of navigation data is on the Electronic Flight Instrument Systems (EFIS). This data is selected for display through the FMS button on the EFIS Display Controller. Once selected for display, the data may be coupled to the autopilot and flight director through the Autopilot Guidance Controller.

FMS/GPS APPROACH CAPABILITIES AND REQUIREMENTS:

The GPS position will automatically be used by the Flight Management System at a 100% weighting factor. If the integrity of the GPS signal is outside of predetermined bounds, the FMS will use the radio navigation sensors for its position solution. Special features in Flight Management System enable it to be used for GPS non-precision approach procedures. These are specially authorized approaches where the GPS sensors must be used to provide navigation guidance. The GPS approaches are "RNAV" approaches in that course guidance is provided between waypoints defined in terms of latitude/longitude coordinates. The GPS approach waypoints are stored in the FMS custom database in a special format that cannot be modified by the aircrew. Logic within the FMS monitors the integrity of the GPS navigation position and alert the crew when integrity is not acceptable.

Integrity is a measurement of the trust which can be placed in the correctness of the GPS position information, e.g., with good integrity the accuracy of the GPS position is guaranteed to be within acceptable limits. The navigation "accuracy" is the measure between the GPS estimated position and true position. The glareshield annunciation "DGRAD" (amber) and "GUIDANCE" (amber) will illuminate when the FMS position loses integrity. However, the accuracy of the FMS position may be good and must be verified by external means whenever the DGRAD and GUIDANCE lights are illuminated. The accuracy and integrity requirements vary with the phase of flight, e.g., en route, terminal and approach.

RAIM, GPS POSITION INTEGRITY

Navigation system integrity refers to the ability of the system to provide timely warnings to users when the system should not be used for navigation. The traditional way of assuring integrity in electronic navigation systems has been to monitor transmitted signals and, if the signals are detected to be out of specifications for any reason, a timely warning is provided to the user. This technique is appropriate for two dimensional systems such as VOR/DME where the accuracy of the signal may be directly related to a known horizontal position. GPS derives its position in four dimensions (latitude, longitude, geometric altitude and time) by interpreting satellite signals whose number and geometry is continuously changing. As a function of satellite geometry and number of satellites in view, the GPS sensor attempts to make determinations of position error. The system will make a decision as to whether the error is outside the allowable limits and if so, a warning will be issued.

Receiver Autonomous Integrity Monitoring (RAIM) is the technique used in this installation for GPS position integrity. To perform the RAIM calculations, at least five satellites with suitable geometry must be in view. Generally speaking the more satellites in view the more robust or creditable the integrity calculation. Conversely, a sparse satellite configuration makes the integrity less reliable and there may be short periods of time when good integrity checks are not possible.

The product (output) of the RAIM calculations is the largest possible error in position in nautical miles to a 99.9% probability. With satellite orbital data, predictions of the systems future integrity are possible. The GPS makes these integrity projections five minutes into the future, the value (5 MIN. RAIM) is available on the GPS status pages on the FMS CDU. Prior to flight, a projection of the RAIM value at the destination airport must be obtained from a ground based computer program that has access to the necessary satellite data.

With only four satellites in view, GPS cannot calculate a RAIM value. This means the integrity of the position is not ensured internally by the GPS sensor. However, with only four satellites GPS may still calculate position accurately. The integrity of the GPS position must then be confirmed by other means, e.g., radar position, DME/DME or VOR/DME position. The FMS systems automatically perform a comparison between the GPS position and the position derived from DME/DME or VOR/DME (ref. "FMS Function and Operations," later in this supplement). Performing GPS integrity checks with radio NAV aids during the enroute and terminal phases of flight is allowed and is automatically performed by the FMS. However, during GPS approaches the integrity of the GPS position must be ensured by RAIM.

DETECTION BIT

The Detection Bit is a flag or message created within the GPSSU (Global Positioning System Sensor Unit) indicating the health of the satellites currently being tracked. If the GPSSU detects some anomaly or aberration with the tracked satellites, the detection bit will be turned ON (set equal to 1). With the detection bit set, the GPSSU is indicating one or more of the tracked satellites are supplying bad data and the GPSSU has not determined which satellite is causing the error. If the system can determine which satellite(s) is corrupt, data from that satellite(s) will be ignored and the detection bit turned OFF (set equal to 0). During the periods the detection bit is ON, RAIM calculations are unreliable and therefore are not displayed on the FMS-CDU or used for GPS integrity. When in GPS approach mode and past the FAF, if the detection bit is set, then the degrade annunciations will illuminate. When in Enroute and Terminal Area modes, integrity is confirmed by VOR/DME or DME/DME sensors.

CIRCUIT PROTECTION

The four circuit breakers for the system are all located in the overhead circuit breaker panel (21VU) as indicated in the following table.

Location	Size	Label	Bus
D6	2 AMP	GPS 1	DC BUS 1
D7	5 AMP	FMS NCU	DC BUS 1
D8	3 AMP	FMS CDU	DC BUS 1
D9	2 AMP	GPS 2	DC BUS 2

SECTION II - LIMITATIONS

FLIGHT MANAGEMENT SYSTEM GENERAL OPERATIONAL LIMITATIONS

1. *HONEYWELL FMZ SERIES FLIGHT MANAGEMENT SYSTEM, PILOT'S OPERATING MANUAL,* Publication Number 28-1146-43-02 dated December, 1990; including temporary revisions 1, 2 and 3, or later Pilot Manual revision; or an FAA accepted Flight Crew Operating Manual incorporating this information must be immediately available to the flight crew.

> Note:
> The *HONEYWELL FMZ SERIES FLIGHT MANAGEMENT SYSTEM*, Pilot's Operating Manual is superseded or augmented by this AFM Supplement in the following functional areas:
> - GPS Status Page and sensor weighting, utilization and annunciation description.
> - GPS Approach selection description and procedures.
> - FMS Setup Pages description and procedures, including; Radio Configuration, Speed Set, Flight Configuration, Engineering Data, Patterns, Holding Patterns, Orbit Patterns, Radial Patterns, Flyover Waypoint and Multiple Patterns.
> - FMS Data Loading description and procedures.
> - New Temporary Waypoint Types.
> - Performance, Perf Index, Fuel Management, Takeoff, Landing, Perf Plan and Wind Temperature, Pilot SDP/FF, and Current GS/FF.

IFR NAVIGATION RESTRICTIONS

IFR navigation is restricted as follows:

1. This AFM Supplement is intended for use with Honeywell software version NZ-9303 or later approved revision.
2. Approval for IFR Navigation is contingent upon the Department of Defense declaration of Initial Operational Capability (IOC) of the GPS satellite constellation, and FAA concurrence for civil operation.
3. IFR navigation is prohibited unless the pilot verifies the currency of the data base or verifies each selected waypoint for accuracy by reference to current approved data.
4. The Honeywell Flight Management System is approved for oceanic, enroute, and terminal operations in accordance with FAA Notice 8110.48.
5. The FMS position information is normally continuously updated and should not require periodic position checking. If the FMS is operating in the degraded mode (e.g. amber DGRAD and GUIDANCE glared shield annunciators ON, and FMS-CDU DGRAD lamp illuminated), position must be checked for accuracy (reasonableness) prior to use as a means of domestic RNAV navigation:
6. The fuel quantity and fuel remaining estimate functions of the FMS are supplemental information only and must be verified by the flight crew.
7. The Attitude and Heading System (AHRS) does not provide true heading to the FMS therefore; FMS operations above 72^{o} 30.0' north latitude or below 59^{o} 30.0' south latitude is prohibited.
8. The holding symbol depicted on EFIS is for reference only and is not scaled to provide an accurate means of navigating. If the holding pattern is to be flown without coupling the flight director to the FMS, the full compass or arc (no map) display formats must be utilized on the EHSI.

GPS APPROACH RESTRICTIONS

1. GPS approaches must be conducted with the Flight Management System in the approach mode. Approach mode is indicated by:
   - A FMS-CDU "APRCH" annunciation, and
   - The glareshield "APRCH" light illuminated.
2. Use of the FMS for approach guidance is prohibited with the FMS operating in the degraded mode, e.g., amber DGRAD and GUIDANCE glareshield annunciators and FMS/CDU DGRAD lamp illuminated.
3. An alternate airport, when required by the applicable operating rules, must be served by an approach based on other than GPS and the aircraft must have operational equipment capable of using that navigation aid.
4. When an FMS-GPS approach is planned at the destination airport, the aircrew must ensure that the RAIM value is 0.30 nautical miles or less for at least ±15 minutes from the estimated time of arrival (ETA), prior to dispatch.

> CAUTION
> Except as specified by this Flight Manual the GPS satellite constellation may not meet the coverage, availability, and integrity requirements for civil aircraft navigation equipment. Users are cautioned that satellite availability and accuracy are subject to change, and appropriate GPS status information should be consulted.

5. If in Instrument Meteorological Conditions (IMC), FMS/GPS approaches may not be flown unless the Flight Director provides lateral steering commands or the autopilot is fully coupled. Pilot, hand flown (manual) approaches utilizing GPS raw data approaches are not authorized.

> Note:
> When the EHSI is displaying FMS data, lateral deviation as displayed by the Course Deviation Indicator (CDI) lacks the sensitivity required to manually fly non-precision approaches. However, CDI sensitivity is adequate for manual flight in the enroute, terminal and approach transition phases of flight.

6. To execute a GPS approach; the FMS must be programmed with approach data from its FLIGHT PLAN database (FPL LIST page of the FMS CDU). The flight crew is required to ensure the approach name/number as extracted from the FMS data base FPL LIST matches the approach name/number as indicated on the currently published instrument approach procedure.

> Note:
> The GPS approach FPL LIST data is not automatically updated with the navigation data base (NDB) on the normal 28 day cycle. Therefore, to ensure the correct approach information is used the above procedure must be strictly observed.

7. During a GPS approach; at least one pilot must be monitoring the GPS lateral deviation in a NON-MAP display format on the EHSI.

SECTION III - NORMAL PROCEDURES

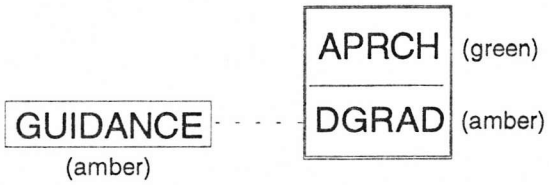
OPERATION

Normal operating procedures are outlined in the FMS Pilot's Manual and the FMS Functions and Operations sub-section of this AFM Supplement.

SYSTEM ANNUNCIATORS

On each of the pilot's and copilot's glareshield panels (131VU and 132VU) are indicators relating to the navigational status of the Flight Management System. The indicators are depicted in the figure to the right and a description of each legend follows.

Pilot's and Copilot's Glareshield Annunciators



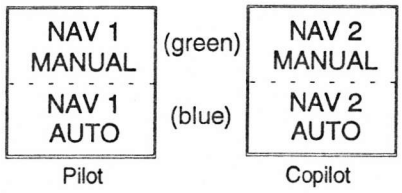
"DGRAD" DEGRADED, AND "GUIDANCE"
The amber "DGRAD" located on the CDU and "DGRAD" and "GUIDANCE" annunciators on the pilot's (131VU) and copilot's (132VU) glareshield panels will illuminate whenever the FMS cannot guarantee the required accuracy for the present phase of flight. Illumination of the annunciator does not necessarily indicate reduced navigational accuracy by the FMS.

"APRCH" APPROACH (GPS APPROACH MODE)
The "APRCH" annunciator located on the CDU and the pilot's (131VU) and copilot's (132VU) glareshield panels will illuminate whenever the FMS is in the GPS approach mode.

> Note:
> A blue "APP" message may appear in the upper left corner of either EHSI if the FMS is being displayed for navigation. This indicates the EHSI Course Deviation Indicator (CDI) is in a higher state of sensitivity.
>
> The EHSI-"APP" will appear for the following reasons:
> - If the FMS is in the GPS approach mode.
> - Distance along the flight plan to destination is less than 10 NM.
> - If the EHSI-"APP" annunciator is illuminated and the aircraft flies out of the above conditions, the EHSI-"APP" annunciator is turned off and the sensitivity is returned to normal.

FMS NAV TUNING OPERATION

Glareshield NAV Radio Tune Switches



The following applies to the VOR/DME navigation radios:

- When the NAV 1 tune switch located in the pilot's glareshield panel (131VU) is in the green manual "MANUAL" position, NAV 1/DME 1 may be tuned from the NAV 1 control head.
- When the NAV 1 tune switch is in the "AUTO" position, NAV 1/DME 1 may be automatically tuned by the FMS computer or the FMS keyboard.

- When the NAV 2 tune switch located in the copilot's glareshield panel (132VU) is in the green manual "MANUAL" position, NAV 2/DME 2 may be tuned from the NAV 2 control head.

- When the NAV 2 tune switch is in the "AUTO" position, NAV 2/DME 2 may be automatically tuned by the FMS computer or the FMS keyboard.

- Reference FMS Pilot's Operating Manual for FMS Autotune details.

FMS SOFTWARE AND NAV DATA BASE (NDB) VERIFICATION

This procedure ensures the proper FMS operating software and navigation database are installed.

- Turn the FMS-CDU on and observe line 3L of the initialization page.

- The word "SW" software followed by a program code will appear. See SECTION II - LIMITATIONS, for proper program version.

- The term "ACTIVE DB" followed by a date will appear, ensure the dates shown are appropriate and valid for the flight date.

GPS APPROACH PROCEDURES:

1. Ensure the RAIM value is 0.30 nautical miles or less for at least ±15 minutes from the estimated time of arrival (ETA) at the destination airport.

2. Select the appropriate GPS approach from the FMS Flight Plan List (ref. "FMS Function and Operations" later in this supplement).

3. Select FMS for navigation (if not already selected).

4. When the aircraft is within thirty (30) nautical miles flight plan length to the destination airport (e.g., distance along the flight plan to the missed approach point). Ensure the following approach annunciators are illuminated:

    a. The FMS-CDU "APRCH" (white) annunciator is illuminated,
    b. "APRCH" (green) on the pilot's (131VU) and copilot's (132VU) glareshield panels are illuminated.
    c. "APP" (blue) message appears in the upper left corner of the EHSI if the FMS is selected for navigation.

5. The autopilot or flight director must be coupled to the FMS for lateral navigation prior to FAF (Final Approach Fix) and on the approach.

6. Use of the autopilot or flight director is not required when there is sufficient visual contact with the runway environment to complete the approach and landing.

> CAUTION:
> Vertical Navigation (VNAV) guidance is advisory only. VNAV guidance is not available through the flight director command bars, and VNAV will not couple to the autopilot. The flight director bars will command flight to the currently selected lateral and vertical mode as shown on the EADI.

Note:
Display of the VNAV Deviation display requires the altitude preselector to be set to the next altitude prior to the aircraft passing the Top Of Descent (TOD). Failure to do this will result in VNAV deviations not being displayed.

7. If not in a position to make a normal landing at or prior to the MAP (missed approach point) execute the missed approach or comply with ATC instructions.

WARNING
IF AT ANYTIME DURING A GPS APPROACH:

1. The FMS-CDU "DGRAD" (amber) annunciator is illuminated, or the "DGRAD" (amber) and "GUIDANCE" (amber) annunciators on the pilot's (131VU) and copilot's (132VU) glareshield panels are illuminated,

----------OR----------

2. The FMS-CDU "APRCH" (white) annunciator is NOT illuminated, or the "APRCH" (green) annunciator on the pilot's (131VU) and copilot's (132VU) glareshield panels are NOT illuminated.

THEN.....THE GPS APPROACH IS NO LONGER VALID...
Execute the published missed approach procedure or obtain a new ATC clearance or comply with previous ATC instructions.

Note:
The following apply when executing a GPS approach:
1. The flight plan can contain only one GPS approach.
2. The GPS approach must be retrieved from the data base to activate all the approach logic.
3. Deletion of the FAF or MAP waypoint will cancel the GPS approach.

FLIGHT DIRECTOR AND AUTOPILOT OPERATION

To display FMS navigation information on either EHSI, select "FMS" on the EFIS Display Control panel. "NAV" may then be selected on the flight director and coupled into the autopilot in the normal manner.

HOLDING PATTERN OPERATION

Normal operation of the holding pattern function of the FMZ-800 is described in the FMS Pilot's Manual. The following operational procedures should be followed:

1. The holding pattern should be defined and activated prior to the lateral waypoint for the holding fix. This avoids a possible leg sequence prior to activating the holding pattern.

2. The default mode for holding pattern leg lengths is 1.5 minutes above 14,000 feet and 1.0 minutes at or below 14,000 feet. The pilot may specify a new leg time or leg distance (not both). Once the leg criteria is activated however, it does not change without further input.

3. The holding symbol depicted on EFIS is for reference only and is not scaled to provide an accurate means of navigating. If the holding pattern is to be flown without coupling the flight director to the FMS, the full compass or arc (no map) display formats must be utilized on the EHSI.

FMS FUNCTION AND OPERATIONS

Functions and operations of the FMS are described in Honeywell Pub. No. 28-1146-43-02 with temporary revisions through number 3. Functions and operations new and unique to this aircraft are included below.

GPS

GPS data can be displayed on the FMS Control Display Unit (CDU). The following data is displayed: GPS position, GPS groundspeed, GPS inertial velocities, GPS altitude, distance of GPS position from FMS position (in nautical miles), GPS figure of merit, GPS vertical and horizontal dilution of precision, GPS UTC, GPS date, GPS navigation mode, the number of satellites in view and tracked by the GPSSU, instantaneous RAIM, 5 minute predictive RAIM, and detection bit status (see figures 1, 2, and 3).

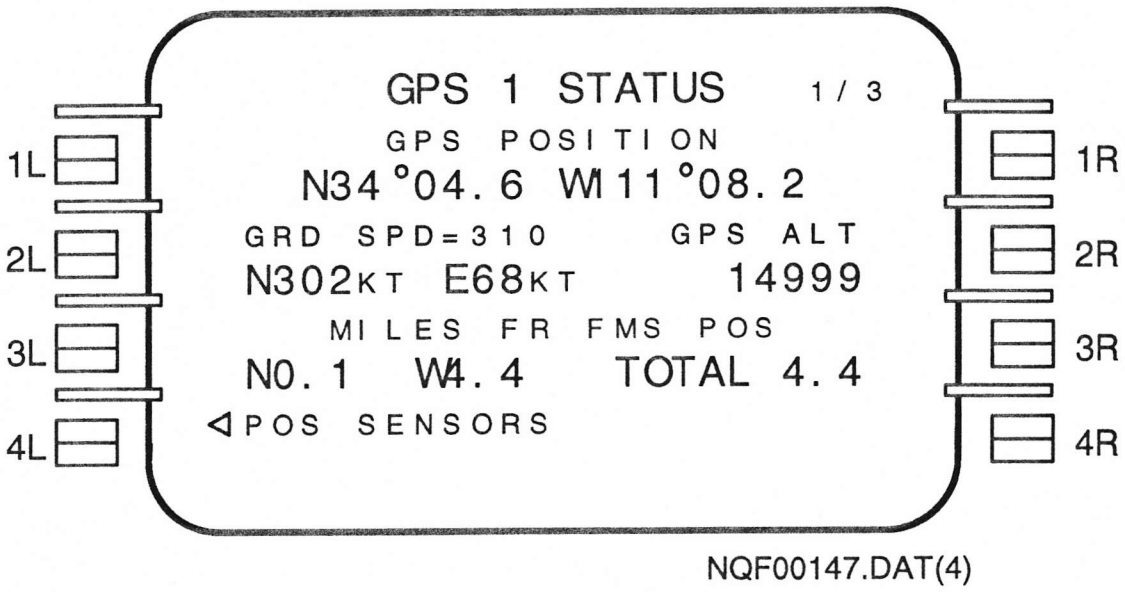


Figure 1

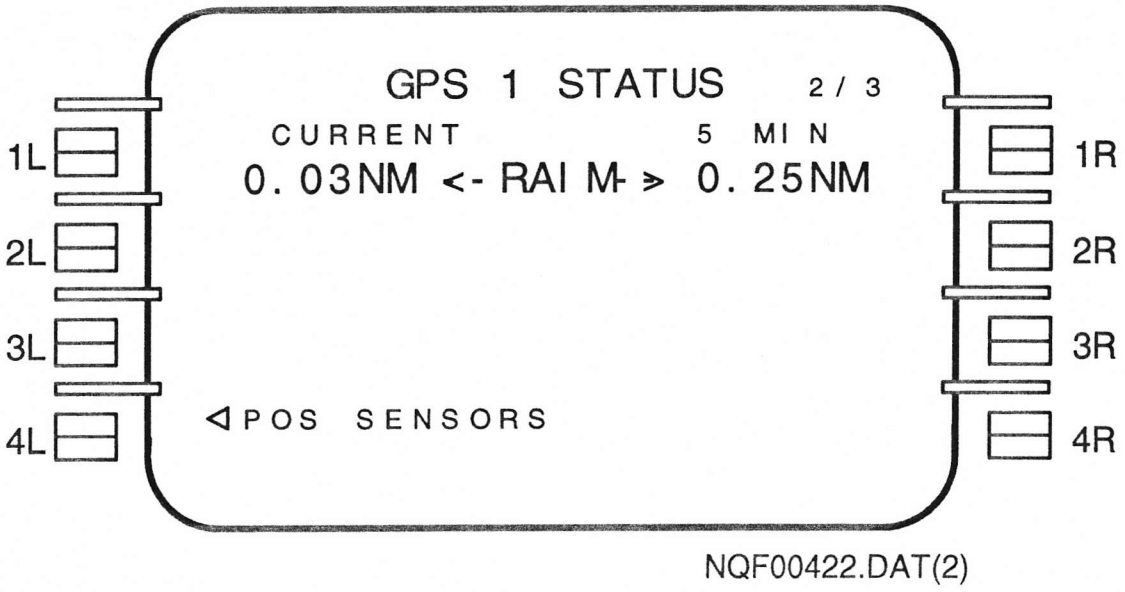


Figure 2

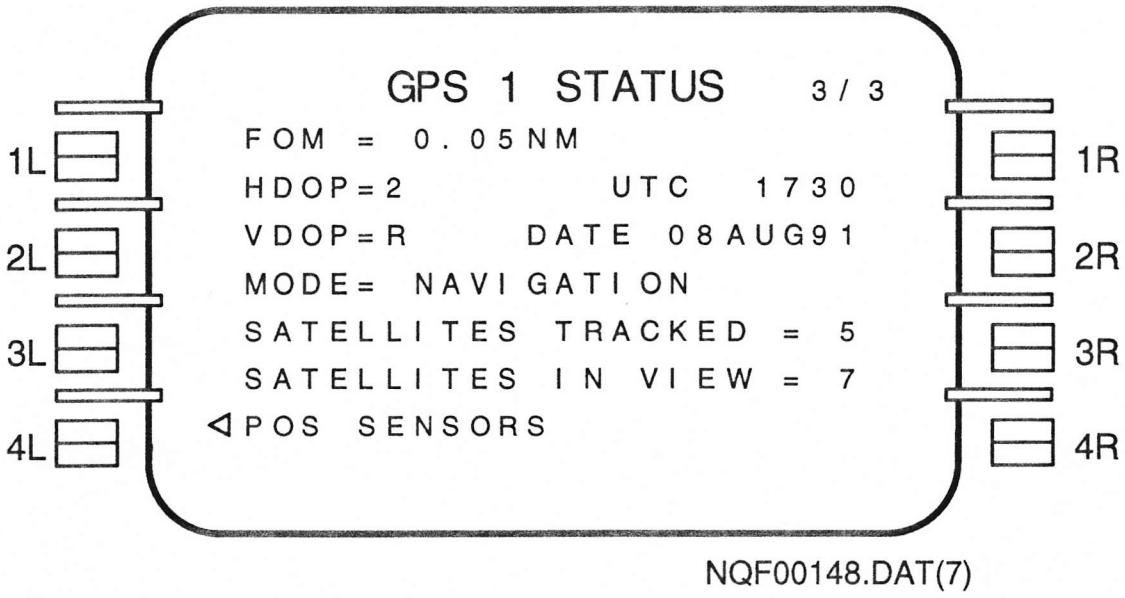


Figure 3

The GPS position will automatically be used by the FMS. If GPS RAIM is within alarm limits for the present phase of flight, the GPS will be used by the FMS at a 100% weighing factor. If GPS RAIM is outside the alarm limits for the present phase of flight, GPS will be compared to the radio position. If the comparison passes, GPS will be used at a 100% weighing factor. If the comparison fails, GPS will not be used and the FMS will derive position from the radios.

The GPS RAIM alarm limits are 2.0 NM for enroute, 1.0 NM for terminal, and 0.3 NM for non-precision approach.

The FMS CDU is equipped with a DEGRAD (degrade) and APRCH (approach) annunciator. These annunciators are used to indicate if the approach selected by the flight crew can be performed. The FMS also provides discretes which illuminate annunciators on the glareshield panel when the degrade and approach annunciator is turned on.

During enroute and terminal operations, the degrade light will turn on if a radio position is unavailable and the GPS RAIM is greater than the alarm limit for 30 consecutive seconds. When the degrade light is turned on, the scratchpad message NO REQUIRED SENSORS is displayed on the FMS CDU. In addition, a EFIS annunciation and discrete output is provided. When the radio position becomes valid or GPS RAIM is less than the alarm limit, the degrade light is turned off.

The above logic also applies when operating in the approach area with no GPS approach selected from the data base. Under this condition, the time is reduced to 10 consecutive seconds instead of 30 seconds.

GPS APPROACH

GPS approaches are selected into the flight plan by using the FPL LIST page (figure 4) or by typing the name of the approach into the scratchpad. This example shows how to select from the scratchpad.

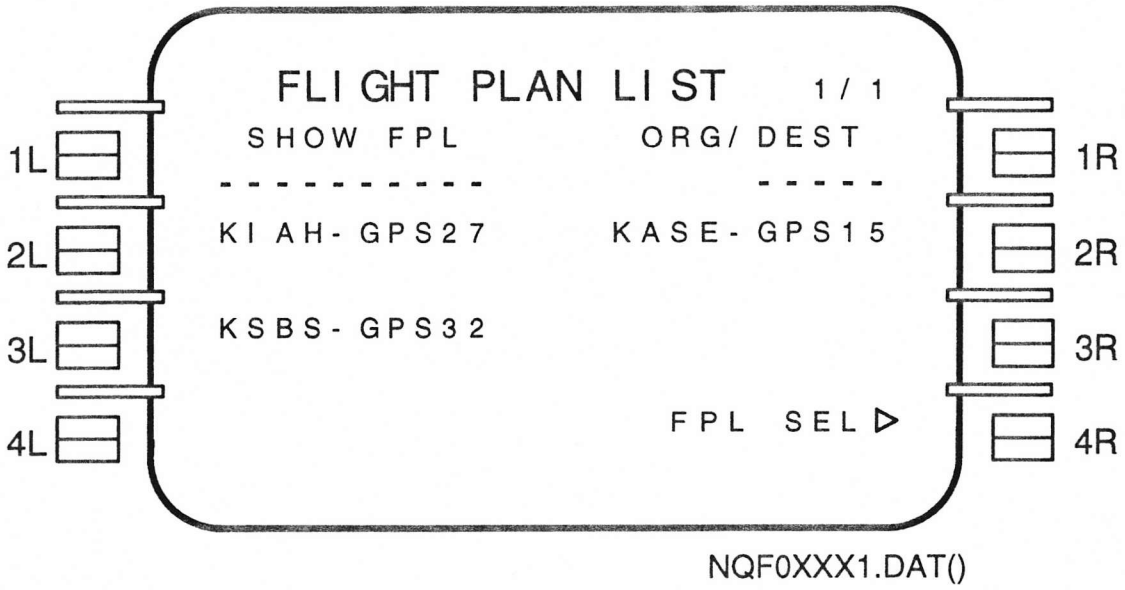


Figure 4

Line selected the desired approach which brings the name of the approach to the scratchpad (see figure 5).

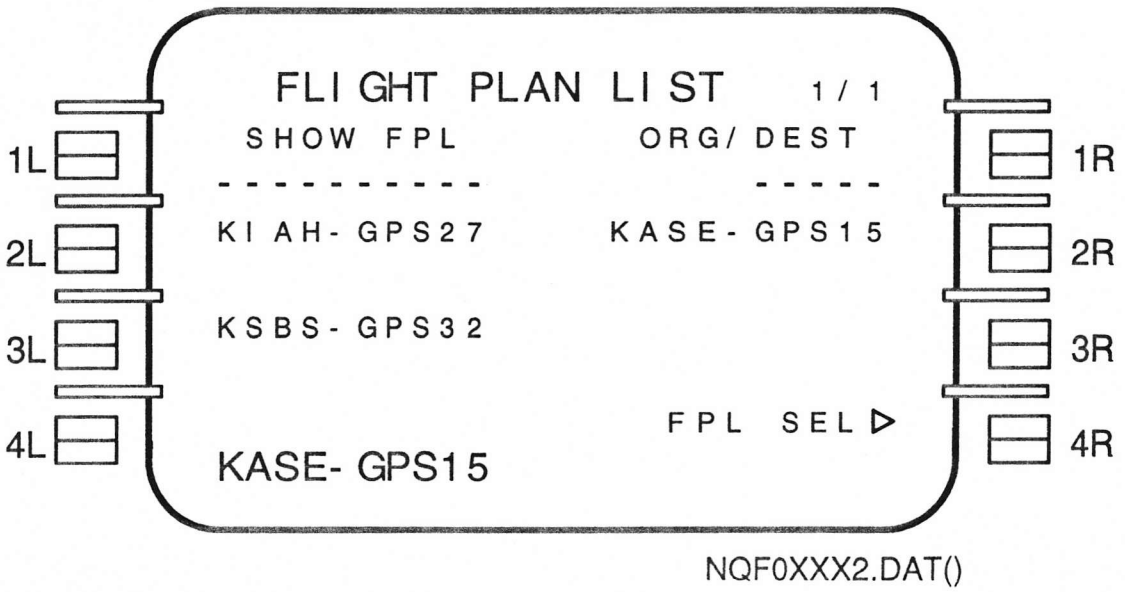


Figure 5

After selecting the approach, select the ACTIVE FLT PLAN page (FPL button on CDU). This displays the active flight plan with the name of the approach in the scratchpad (figure 6). As an alternative to going the FPL LIST pages, the name of the approach could be entered from the keyboard into the scratchpad and accomplish the same thing. If necessary, use the page keys to display the correct portion of the flight plan. Insert the GPS approach by line selecting the name of the approach from the scratchpad to the appropriate place in the flight plan (see figure 7).

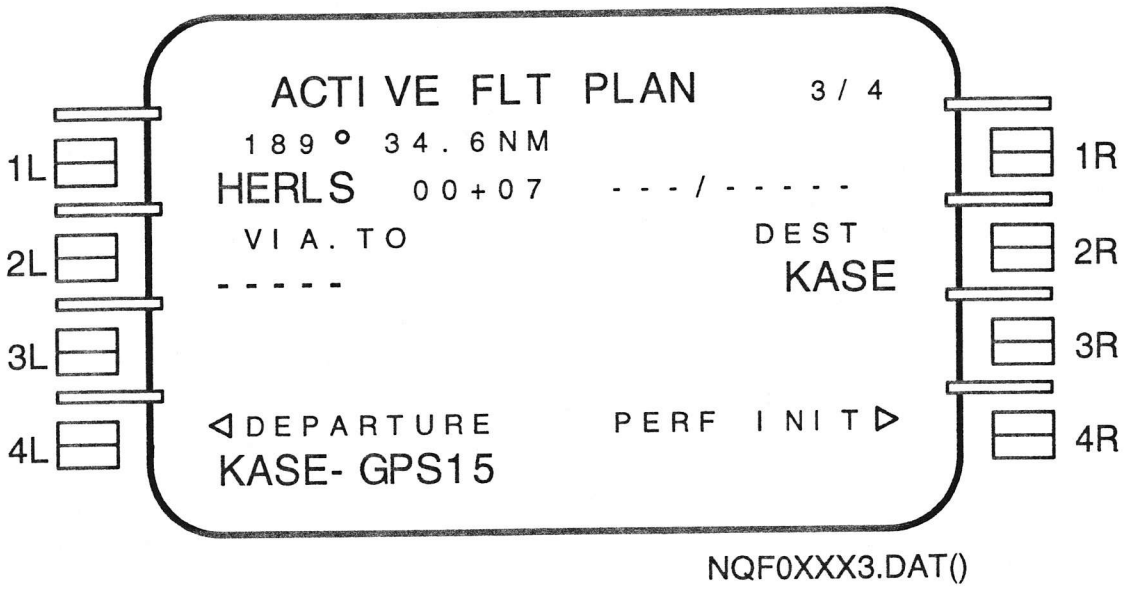


Figure 6

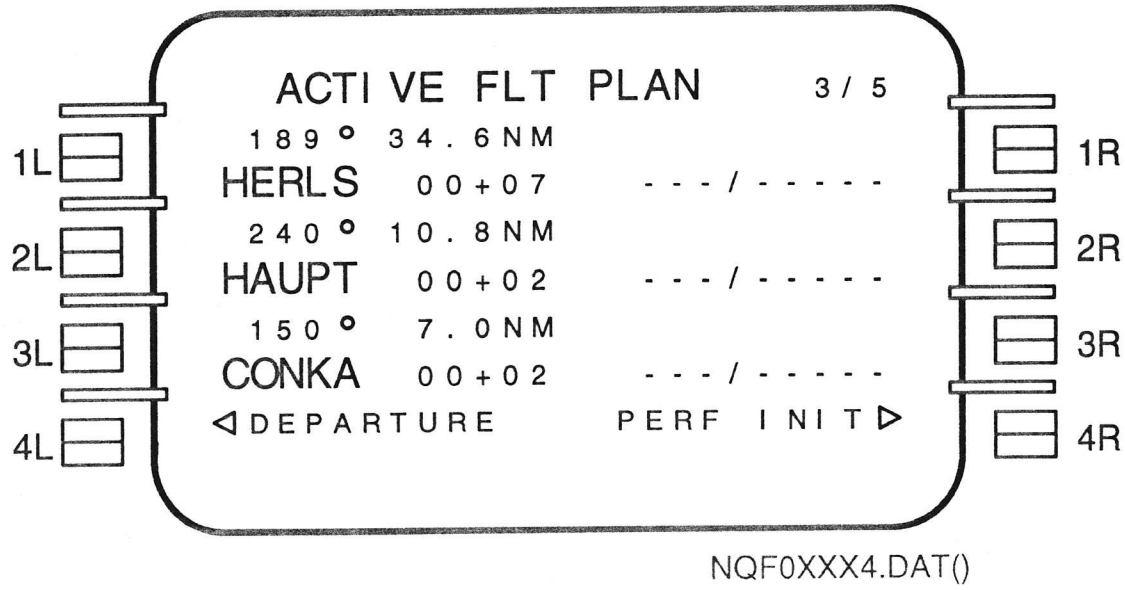


Figure 7

During GPS approaches, the degrade light turns on when the current or predictive GPS RAIM exceeds the approach alarm limit or the detection bit is set to 1. The degrade light remains on until the condition no longer exists. The scratchpad messages provide additional information to the flight crew as to why the degrade light turned on. If GPS RAIM exceeds the approach alarm limit when operating in the approach area, the scratchpad message GPS RAIM ABOVE LIMIT is displayed when the degrade light turns on. If GPS RAIM becomes invalid or the detection bit from the GPSSU is set, the scratchpad message GPS RAIM UNAVAILABLE is displayed when the degrade light turns on, and the scratchpad message GPS UNAVAILABLE AT DEST is displayed when the 5 minute predicted RAIM exceeds the approach alarm limit.

Special logic exists in the FMS with regard to the degrade light when the aircraft has passed the FAF of a GPS approach. If current GPS RAIM becomes unavailable past the FAF, the FMS will not turn on the degrade light until 5 minutes has elapsed or the MAP is sequenced. If GPS RAIM exceeds the alarm limit past the FAF, or the detection bit is set, the degrade light is turned on and the appropriate scratchpad message is displayed.

The approach annunciator is turned on when the FMS is configured properly for the approach selected from the FMS data base. For the GPS Approach Program, the data base contains only GPS approaches. Thus the annunciator is turned on when a GPS approach is selected and a GPS sensor is providing a current and predictive RAIM less than the alarm limit and the detection bit is not set. Under these conditions, the approach light will turn on when the aircraft is in the approach area.

The approach annunciator is turned off when the degrade annunciator is turned on. It is not possible for the FMS to be configured properly for an approach if the FMS is using sensors not approved for the current phase of flight (which is indicated by the degrade light). Thus only the approach or degrade light will be turned on when a GPS approach has been selected and the aircraft is operating in the approach area.

FMS SETUP PAGES

An FMS setup function has been added to the FMS to replace the configuration pages as discussed starting on page 8-2 of the FMS pilots manual.

The setup pages are accessible from MAINTENANCE 2/3 using line select 4L (figure 8). This displays the FMS SETUP page as shown in figure 9. From this index page, the various setup pages can be selected. The pages are described below. ENGR DATA at 2R selects an additional index page from which many pages of engineering data can be selected. These pages are intended to be used under the direction of Honeywell in testing the FMS.

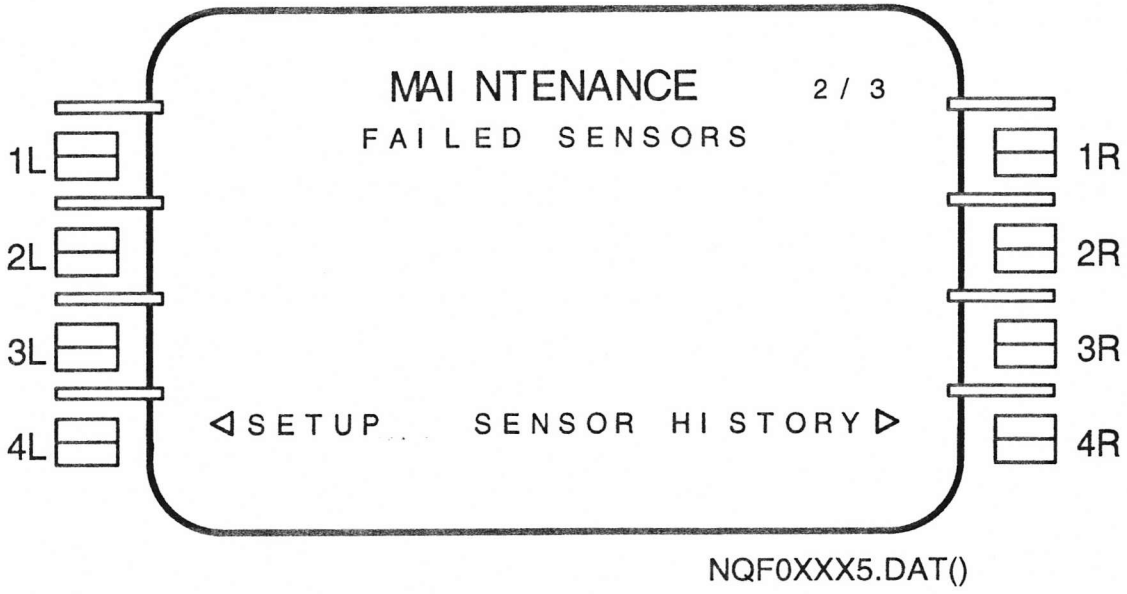


Figure 8

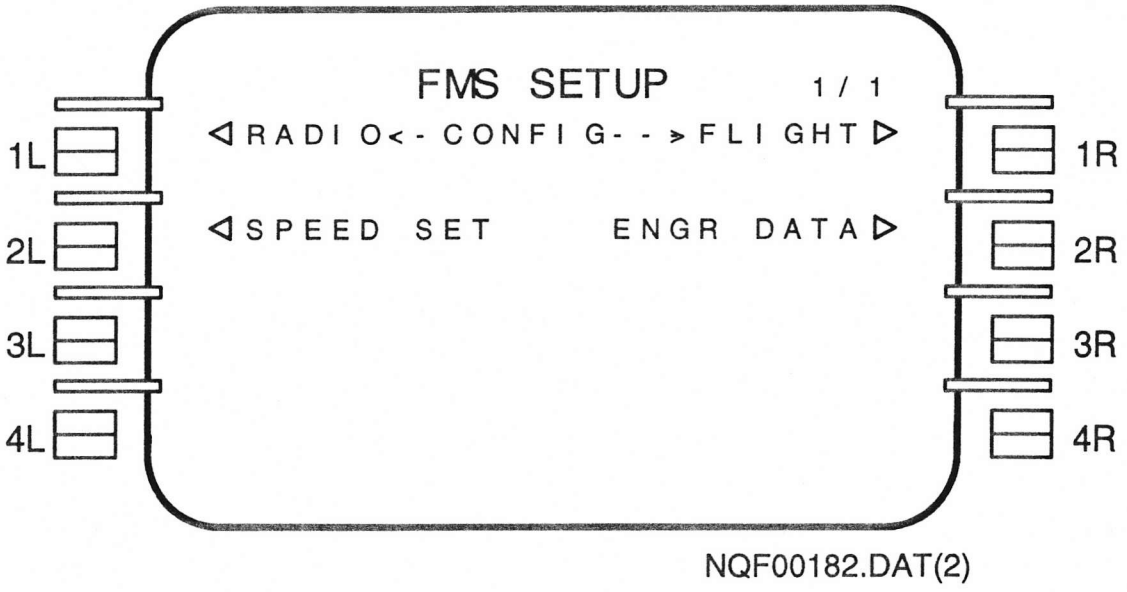


Figure 9

RADIO CONFIGURATION

The RADIO CONFIG page is accessed from FMS SETUP line select 1L. The radio configuration pages work as described starting on page 8-2 of the FMS Pilot's Operation Manual.

Speed Set

The SPEED SET page is accessed from FMS SETUP line select 2L. The SPEED SET pages work as described starting on page 8-3 of the FMS Pilot's Operation Manual with the exception of now there are pages for takeoff and pages for landing. On this application, speed bugs are not displayed on EFIS.

FLIGHT CONFIGURATION

The FLIGHT CONFIG page is accessed from FMS SETUP 1R.

- **FLIGHT CONFIG 1/2** (figure 10) is used to set bank angle limits, auto paging, and display options.

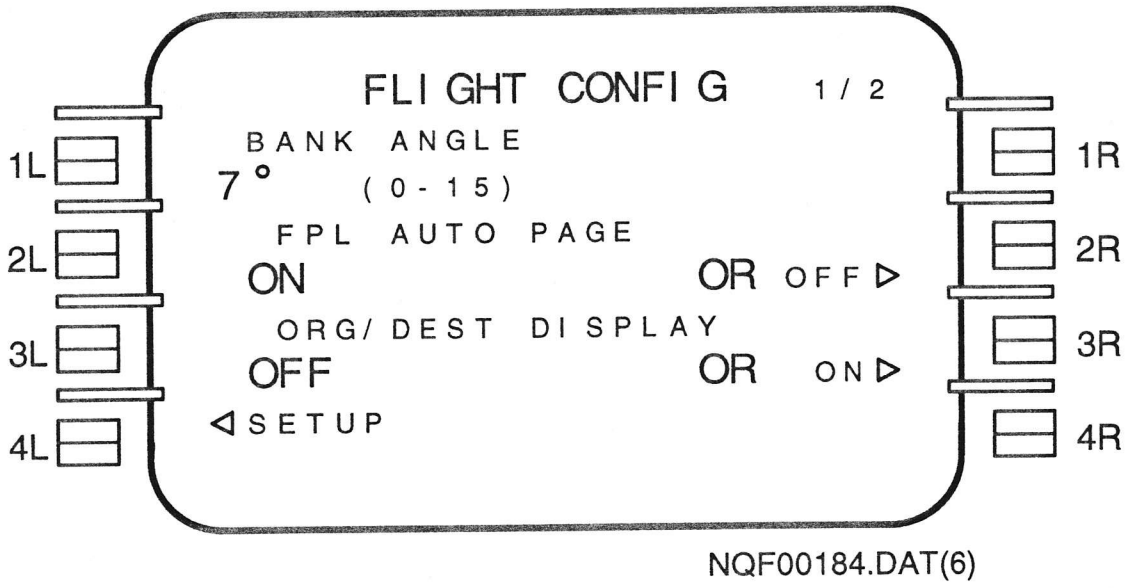


Figure 10

- BANK ANGLE - The BANK ANGLE is used to set bank limits. The default is 7. Any number from 0 to 15 can be entered. The BANK ANGLE is the highest bank angle to be used by the FMS unless higher is needed to maintain protected airspace.

  The FMS incorporates a model of the protected airspace which includes the tighter restrictions at low altitudes. The FMS checks each turn against the model and increases the bank angle above the entered BANK ANGLE, if required.

  The BANK ANGLE can be entered at anytime but only on the master CDU.

- AUTO PAGE - The AUTO PAGE feature applies when building flight plans. With AUTO PAGE on, the FMS automatically advances the page when the third waypoint is entered on any given page. AUTO PAGE continues until the destination is entered as a waypoint on the left side of the page.

NOTES:

1. AUTO PAGE works for both active and stored flight plans.
2. After the third waypoint is entered on a page, there is a slight delay before the page is advanced.
3. When an airway is entered, AUTO PAGE does not advance the pages.

- ORG/DEST DISPLAY - The FMS outputs for display, a list of the closest airports. This selection gives the option of always including in the list, the origin and destination airport even when not among the closest. If the selection is ON, the origin and destination airports are always included in the list. If the selection is OFF, the origin and destination airports are only included when among the closest. The default is OFF.

• **FLIGHT CONFIG 2/2** (figure 11) is used to select the patterns option of the FMS.

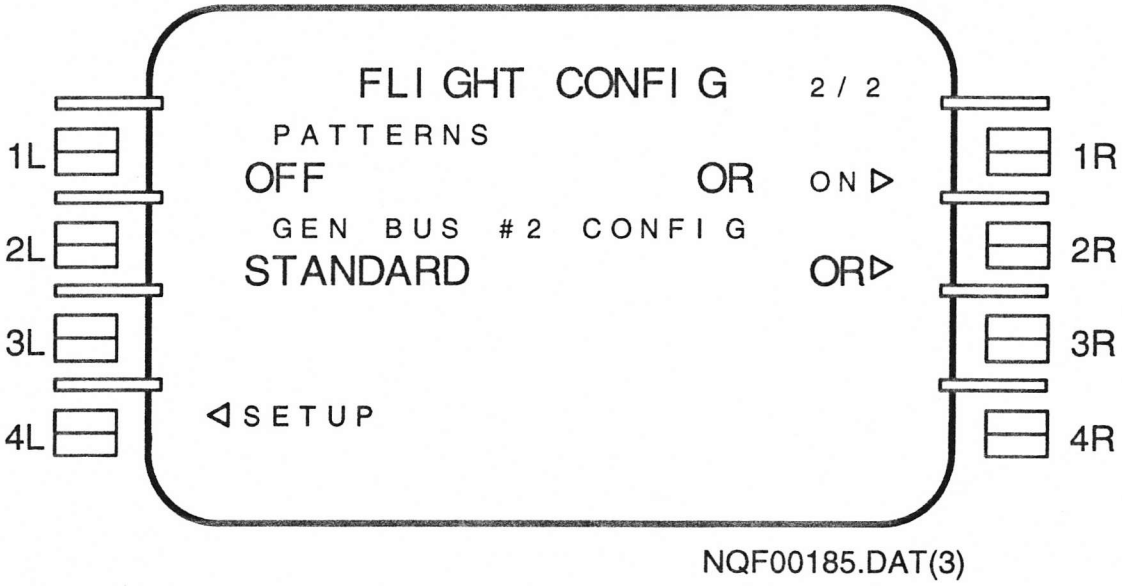


Figure 11

- PATTERNS - Additional patterns beyond holding have been added to the FMS. This selection make those additional patterns available. If the selection is OFF, only holding patterns are available. If the selection is ON, all patterns in the FMS are available. The default is off.

- GEN BUS #2 CONFIG - This selection (2R) displays the GEN BUS #2 CONFIG page (figure 12). The selected option determines the output information on general 429 bus #2. For the ATR-42 aircraft, the selection should always be standard. For the Dash-7 aircraft, the selection should always be Electro mech.

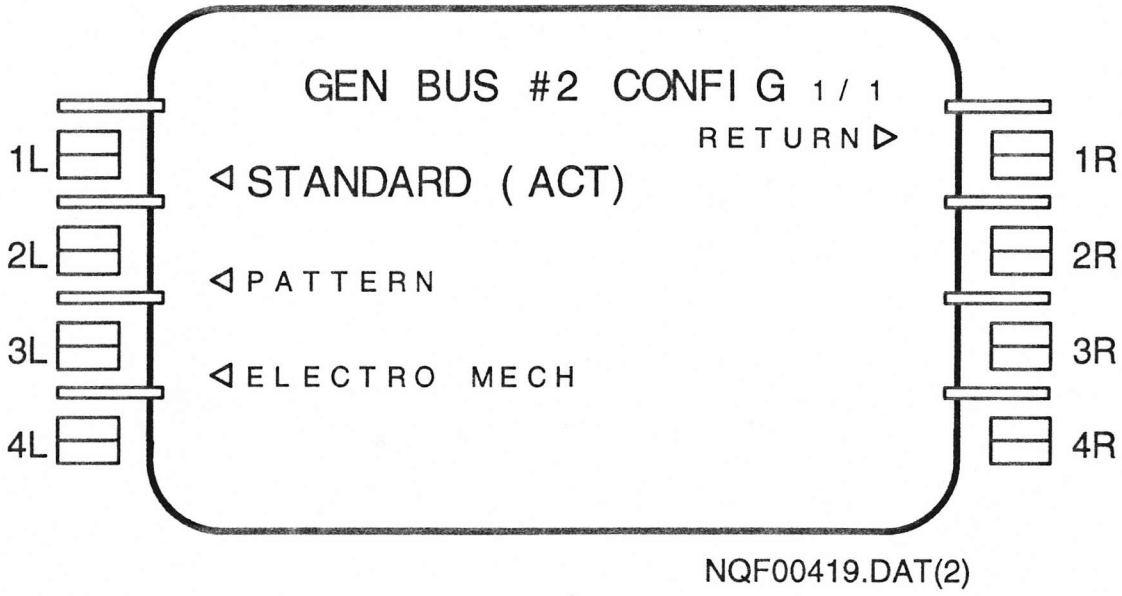


Figure 12

ENGINEERING DATA

The ENGINEERING DATA page is accessed using 2R on the FMS SETUP page (figure 9). This page (figure 13) is an index of the available options. These functions are primarily used under the direction of Honeywell engineering in finding and solving problems with the FMS.

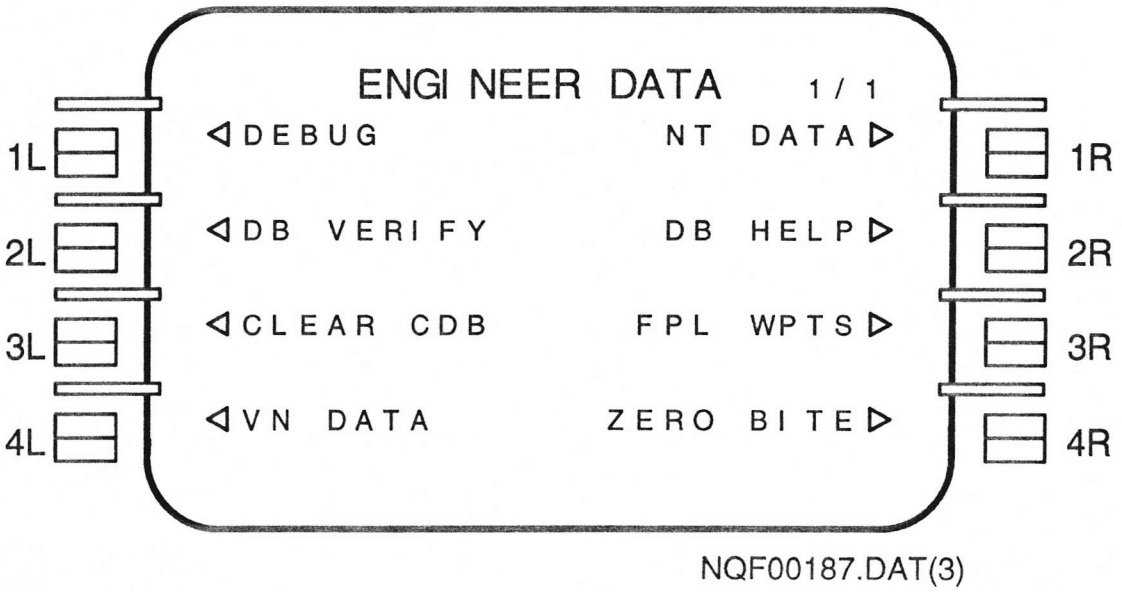


Figure 13

- ENGINEERING DATA 1/1 is used to select the various functions. For each function, additional pages may be displayed.

  - DEBUG - This functions allows for uploading and downloading of diagnostic information using the data loader. Also, it can be used to format a disk.

  - NT DATA - This function gives access to pages which display information about each navaid which is a candidate for tuning. These pages are displayed only with no action permitted.

  - DB VERIFY - This function provides a test for the database. If the NAV database becomes invalid, it is helpful to run this test. Select this prompt, load the same database which is in the computer from disk and record the EEPROM failures if any at the end of the test.

  - DB HELP - This allows looking at specific location within the database memory. It is only useful under the direction of engineering since memory locations change with each database update.

  - CLEAR CDB - Clearing of the custom database can be selected at this prompt. Further selection is provided for clearing of pilot defined waypoints, stored flight plans, NOTAMs, or all the above. Once a selection is made, wait for the action to be completed before selecting another option on this page.

  - FPL WPTS - This selects pages which display FMS internal data about waypoints in the flight plan. These pages are display only and no action is permitted.

  - VN DATA - This selects pages which display FMS internal data about the vertical navigation function. These pages are display only and no action is permitted.

PATTERNS

In addition to the holding pattern feature of the FMS, additional patterns have now been added to the FMS. This is a pilot selected option as described under FMS SETUP (see figure 11). If the pattern option is selected off, operation of holding patterns is as described in the FMS Pilot's Operating Manual. If the pattern option is selected on, operation is as described below.

Pattern selection is available for both the active and stored flight plans. For active flight plans only, the prompt at 4L when selecting the DIR key is PATTERN. For stored flight plans, the prompt at 4L is always PATTERN. If patterns are selected OFF, the active flight plan prompt at 4L is HOLD when selecting the DIR key. The stored flight plan prompt is FPL LIST. In either case, the procedures for selecting and defining the patterns are similar. The following are the general rules applicable to all patterns. Specifics follow on the following pages.

PATTERN DEFINITION

Step 1 - Select the DIR function key (figure 14).

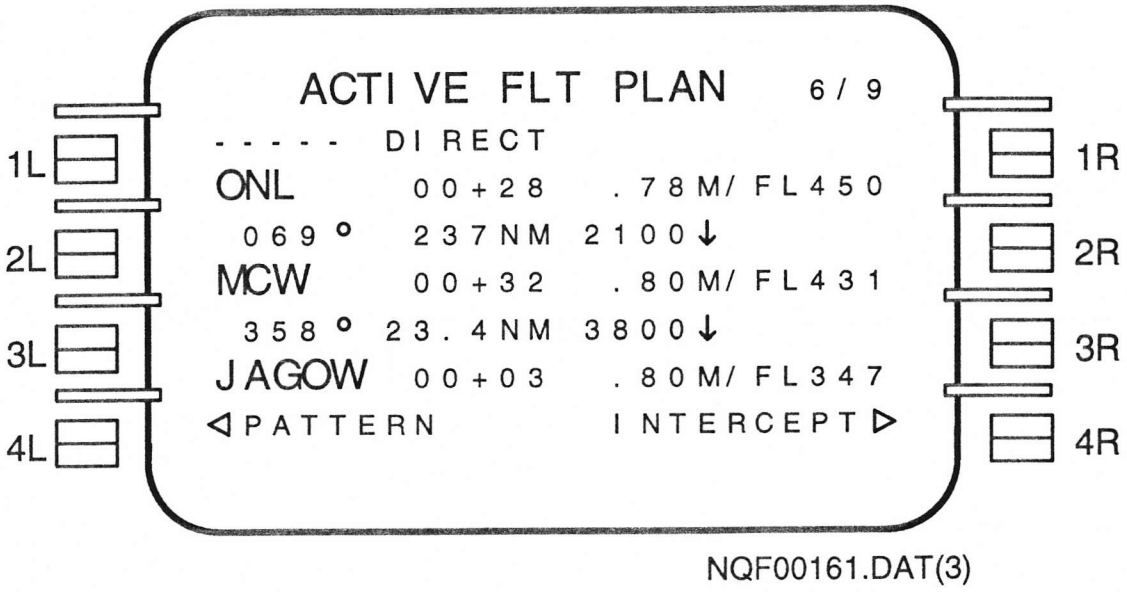


Figure 14

Step 2 - Select the prompt at 4L. If the prompt is HOLD, *HOLD* will be displayed in the scratchpad, go to step 4. If the prompt is PATTERN, the PATTERNS page (figure 16) will be displayed.

Step 3 - Select the desired pattern. In this example, HOLD (1L) is selected. This places *HOLD* in the scratchpad and displays the flight plan page (figure 17)

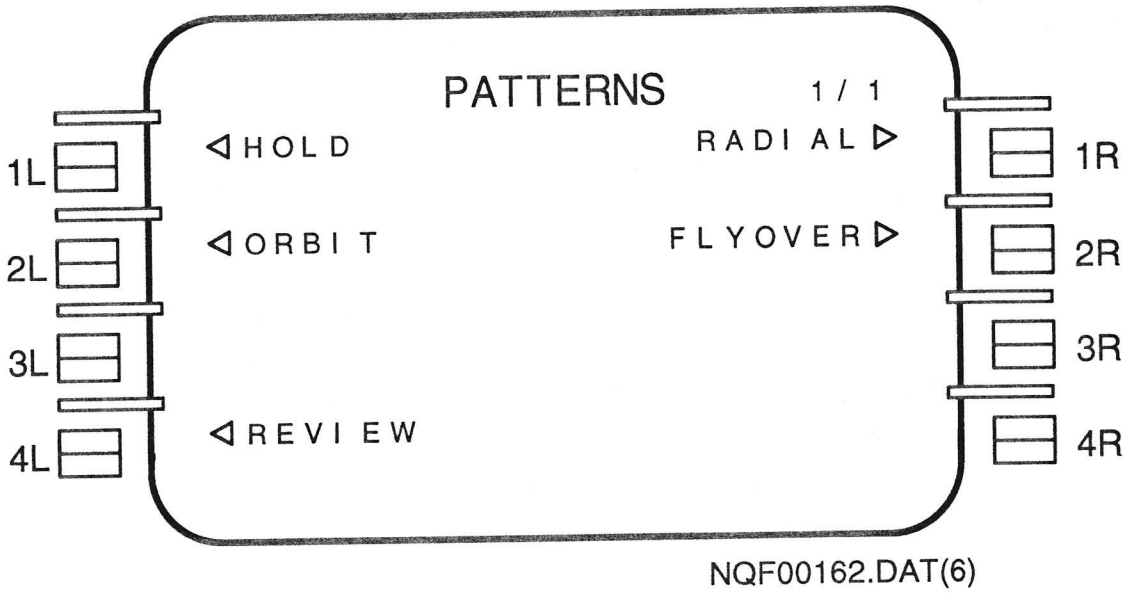


Figure 15

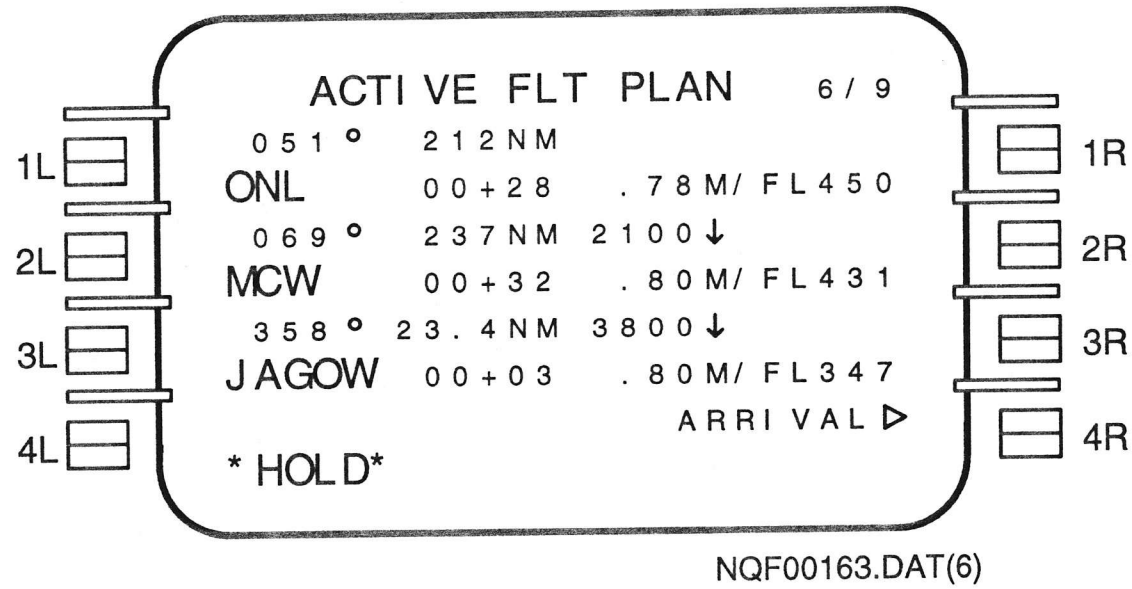


Figure 16

Step 4 - Insert the pattern name from the scratchpad by selecting next to the desired pattern waypoint. This will display the definition page for the pattern (figure 17). Flyover requires no definition page.

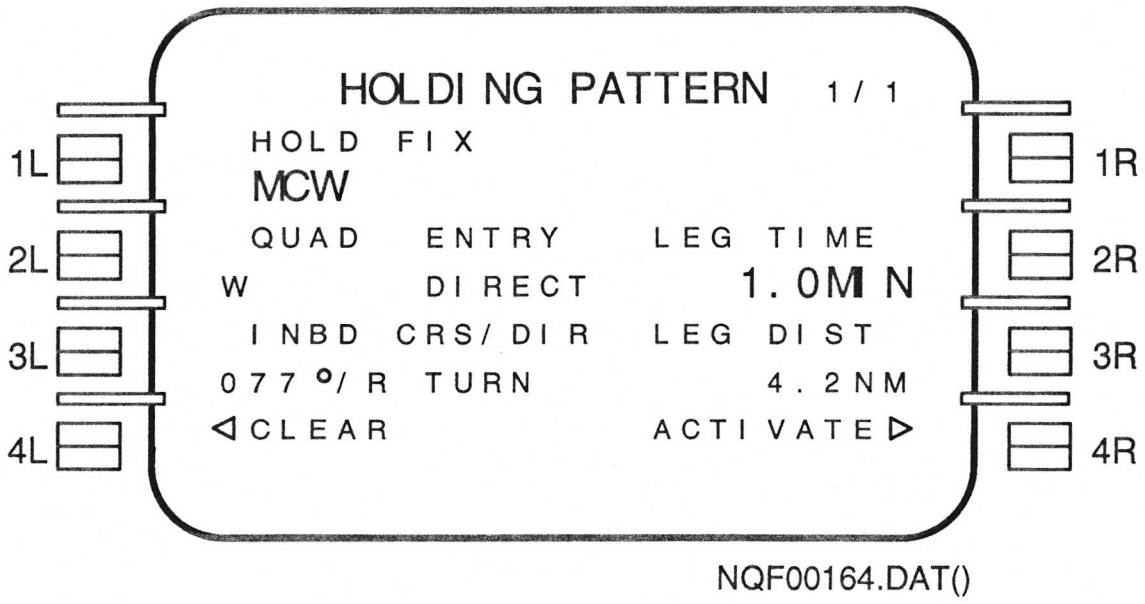


Figure 17

Step 5 - Define the pattern as desired and ACTIVATE (4R figure 17) which displays the flight plan page with the pattern displayed at the pattern waypoint (figure 18).

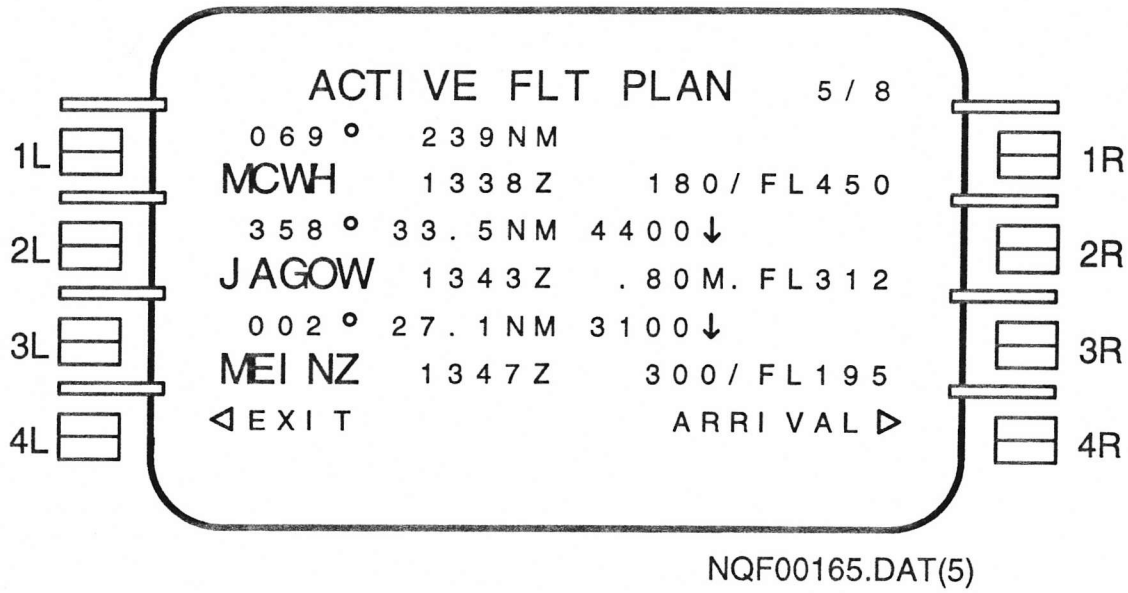


Figure 18

NOTE: The H at the new waypoint is actually in inverse video.

PATTERN REVIEW

If PATTERNS are selected OFF, review of a previously defined holding pattern is accomplished by selecting the HOLD PAGE prompt at 1R on NAV INDEX page 2.

If PATTERNS are selected ON, review can be accessed by selecting the PATTERN prompt at 1R on NAV INDEX page 2 or by selecting the DIR key, selecting PATTERN (4L), and selecting REVIEW (4L). This will review all patterns of all types in the applicable flight plan.

The accuracy of performance data is dependent upon the accuracy of the PERF INIT data. Cruise wind and temperature input can have a significant impact. Fuel and time predictions for orbit and holding patterns assume flying once around the pattern. If the pattern is started over, the fuel and time predictions are incremented to account for the next pattern.

See below for specifics on each type of pattern.

HOLDING PATTERN

The HOLDING PATTERN page is used to control the inbound heading, turn direction, and leg length or time of the inbound leg of a holding pattern.

The HOLDING PATTERN page is accessed by selecting the HOLD PAGE prompt (the prompt is PATTERN if the patterns option is configured) displayed on the NAV INDEX page or from the ACTIVE FLT PLAN page. If a holding fix has not been defined, the HOLDING PATTERN page defaults to holding at present position when on the flight plan or indicates that no holding pattern has been defined (figure 19) when off the flight plan.

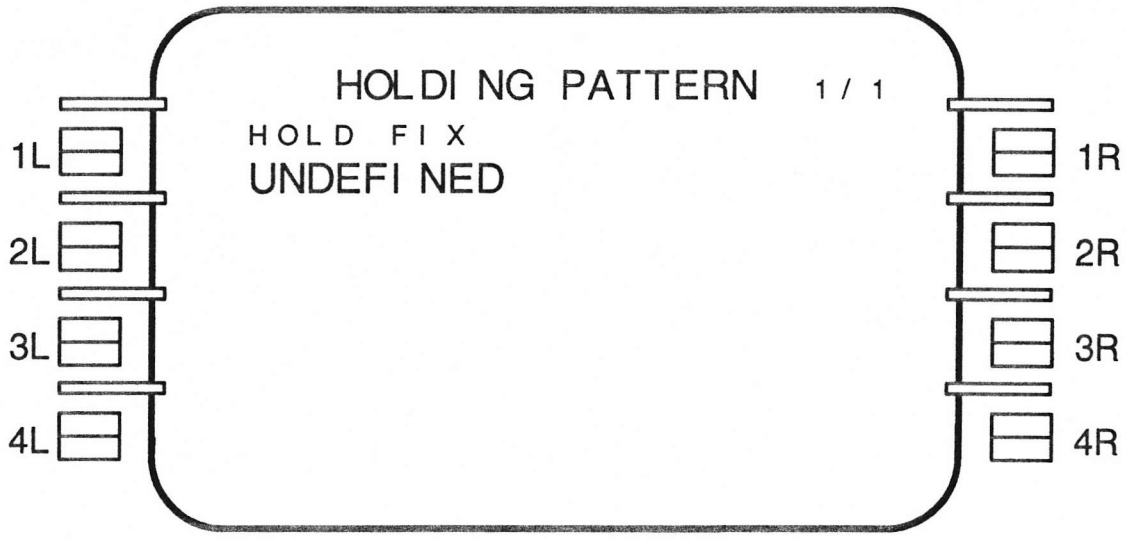


Figure 19

A holding pattern can be defined using the general steps given above. In addition to the general steps, the pilot may choose to hold at a waypoint in the flight plan or at the present position of the aircraft. To hold at a waypoint in the flight plan, the pilot presses the line select key to the left of the desired waypoint. The FMS then displays the HOLDING PATTERN page with the desired waypoint as the holding fix.

To hold at the present position of the aircraft, the pilot presses the line select key (1L) to the left of the FROM waypoint (first waypoint on the first page of the ACTIVE FLT PLAN). The FMS then displays the HOLDING PATTERN page with *PPOS (present position) as the holding fix.

NOTE: Holding at the present position is only permitted when LNAV is captured and the cross-track error is less than 0.25 NM.

For example, it is desired to hold at MCW. The DIR key is pressed, HOLD is selected, and MCW is designated as the holding waypoint. The FMS displays the HOLDING PATTERN page with MCW as the hold fix (figure 20). From this page, the pilot may define:

- Quadrant
- Inbound course
- Direction of turn
- Leg time or length.

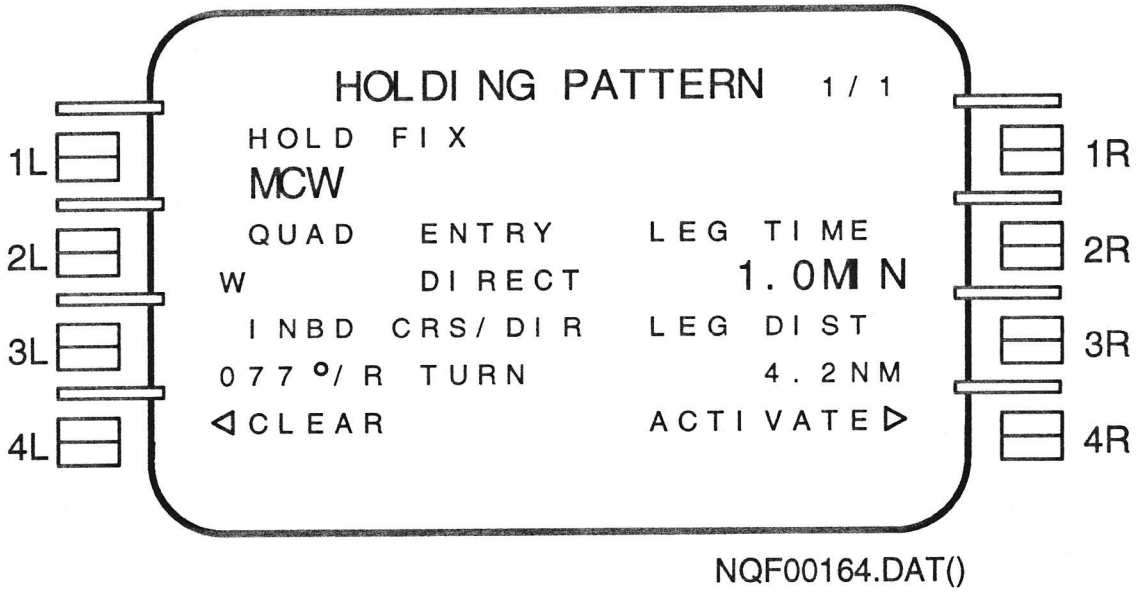


Figure 20

It is important to note that all pilot entries or controlling entries on the HOLDING PATTERN page are displayed in large capital letters. FMS computed entries are displayed in small capital letters.

ORBIT PATTERN

The orbit pattern is used to fly an orbit (circle) around a given waypoint at a distance from 1 NM to 99.9 NM. After selecting the pattern waypoint, the ORBIT page is displayed (figure 21). Enter the desired radius (1R), the desired speed (2R), if different from the default, and direction (3R), if different from the default. The pattern can now be activated (4R). Orbit patterns are designated with an inverse video "O" on the pattern waypoint. As the aircraft approaches the orbit, it will transition into the orbit and fly at the specified radius around the waypoint. A prompt is provided on the active flight plan page for reversing the direction of flight once on the orbit. The reversal turn is always accomplished to the outside of the orbit.

NOTE: Orbit patterns are allowed on all waypoints except the FROM waypoint.

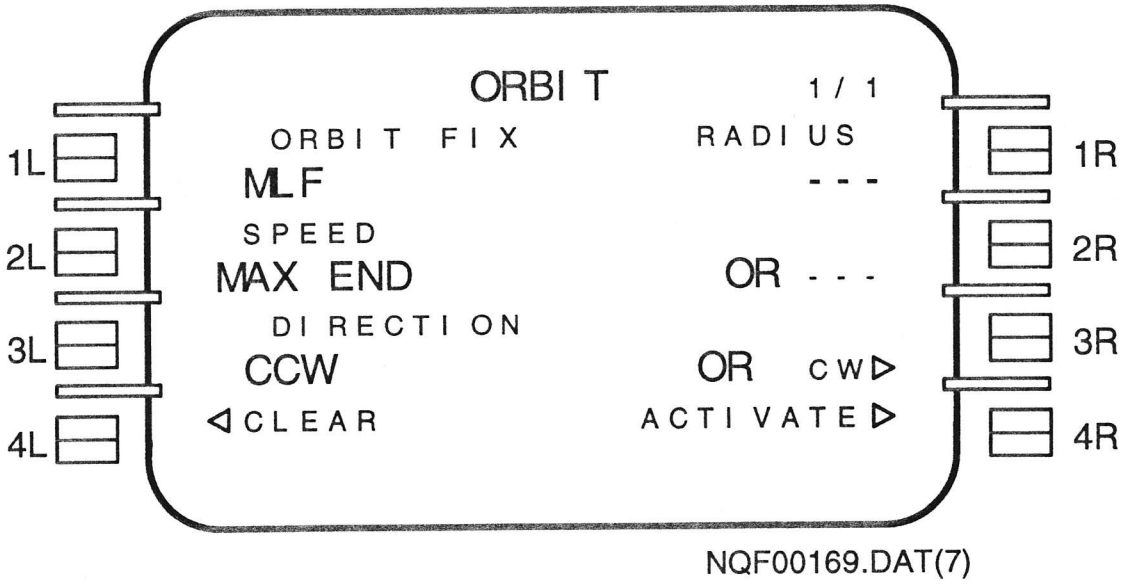


Figure 21

An orbit pattern can be deleted from the flight plan by selecting *DELETE* from the scratchpad to the appropriate waypoint. On the active flight plan, deletes are not permitted when within a minute of the pattern. In this case, the EXIT prompt (4L) can be used to remove the pattern.

When within one minute of entry to the orbit, the EXIT prompt is displayed at 4L on the active flight plan page. Selecting this prompt causes the aircraft to immediately leave the orbit and proceed to the next waypoint in the flight plan.

RADIAL PATTERN

A radial pattern is used to fly a radial inbound and/or outbound from a given waypoint. This capability is very similar to defining place/bearing/distance waypoints.

NOTE: Inbound and outbound radials are both defined using radials, not courses.

After inserting the pattern at the desired waypoint in the flight plan, the RADIAL page (figure 22) is displayed. As a minimum, an inbound or outbound radial and associated distance must be defined in order to activate the pattern. Both may be defined if desired. Once defined, activate the pattern. A radial pattern is displayed as an inverse video "R" in the flight plan. Temporary waypoints are inserted in the flight plan to properly fly the radials as defined, i.e. *PBD01. When inbound and outbound radials are defined, the outbound temporary waypoint will have a smaller numerical index than the inbound. The inserted waypoints are displayed in inverse video. Insertion of other waypoints between radial waypoints is not allowed by the FMS.

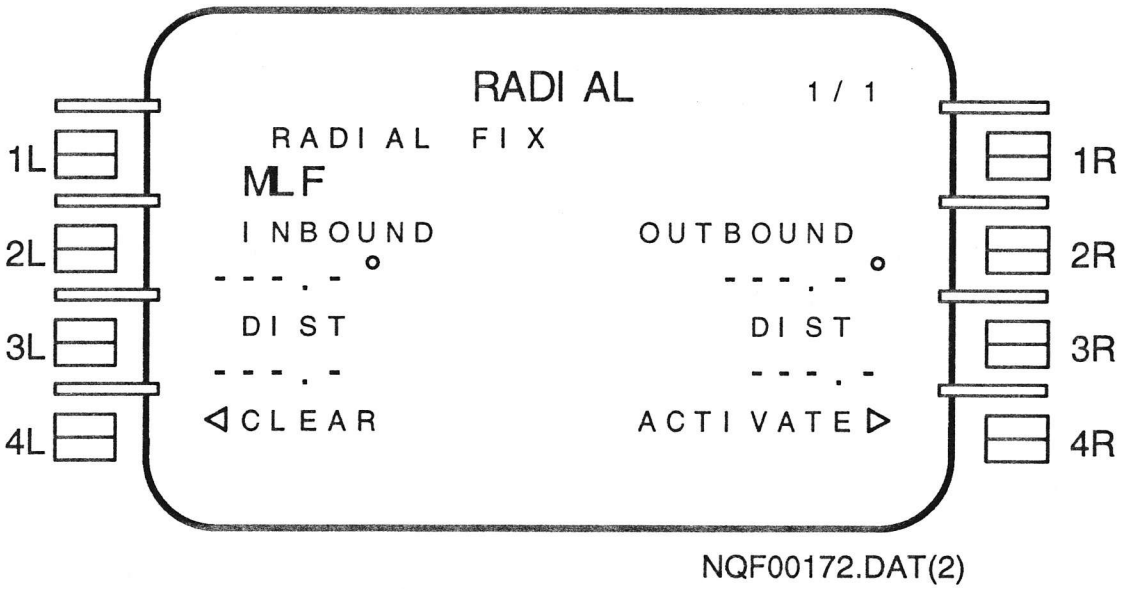


Figure 22

If both an inbound and outbound radial are defined, two temporary waypoints are inserted in the flight plan. In this case, either waypoint can be deleted individually and the remaining leg will remain in the flight plan. If only one waypoint was inserted or remains in the flight plan, deleting it will remove the waypoint and the pattern.

Since a radial pattern is flown as a normal leg between waypoints, there is no exit procedure. The normal DIRECT-TO and waypoint delete can be accomplished as needed.

FLYOVER WAYPOINT

Once *FLYOVER* has been selected to the scratchpad, insert at the desired waypoint. There is no more required definition and the flyover is displayed as an inverse video "F" adjacent to the course into the waypoint. With this option, the aircraft will proceed to the waypoint prior to the start of turn.

Select *DELETE* from the scratchpad to delete the flyover. Only the flyover will be deleted, not the waypoint. A second delete can be used to delete the waypoint.

There are no exit procedures. Either delete the flyover or use the normal methods of changing the flight plan.

MULTIPLE PATTERNS

It is possible to have multiple patterns in any given flight plan when PATTERNS are selected ON. It is also possible to have multiple patterns on a given waypoint. The following indicates the possible combinations.

Pattern Name	Additional Pattern Permitted
ORBIT	NONE
RADIAL	HOLDING, FLYOVER
HOLDING	RADIAL
FLYOVER	RADIAL

If multiple patterns exist at a waypoint, the order of delete is FLYOVER, HOLD, RADIAL. If a HOLD or ORBIT is defined on a waypoint with a FLYOVER, the FLYOVER is automatically deleted.

- **VNAV and Holding or Orbit Patterns** - There are some special considerations for holding and orbit patterns during VNAV operation.

  - Path descents are not permitted during holding or orbit pattern operations. If the holding or orbit is entered while in VPATH, VNAV transitions to FLCH and continues the descent.

  - If the holding or orbit pattern is entered while in VFLCH, the aircraft remains in VFLCH and continues the climb or descent.

  - If the holding or orbit pattern is entered while in VALT, the aircraft remains in VALT

  - If a PPOS holding pattern is entered while in a path descent, the aircraft transitions to VFLCH while in holding.

  - If the holding or orbit pattern is entered at a waypoint which is part of a path descent, VNAV will transition into VALT at the constraint altitude or the predicted altitude for the pattern waypoint.

DATA LOAD

In addition to the data load functions described in the FMS Pilot's Operating Manual, the capability to download and upload the custom data base to/from the data loader has been added.

The custom database can be transferred to or from the data loader. When loading the custom database from the loader, the custom database is completely replaced by the contents of the disk including stored flight plans and pilot defined waypoints. When transferring the custom database to a disk, both the pilot defined waypoints and flight plans are transferred. This option allows for a permanent record of the custom database to be kept for loading in case of computer replacement or other losses of the custom database. In order to transfer the custom database to the data loader, insert a formatted disk. If the disk is not formatted, it can be formatted using the MAINTENANCE page DEBUG option (see figure 13). Use the following steps:

STEP 1 - Select the DATA LOAD page from the NAV INDEX, page 2, line select 4L.

STEP 2 - Select CUSTOM DB (2L) (figure 23)

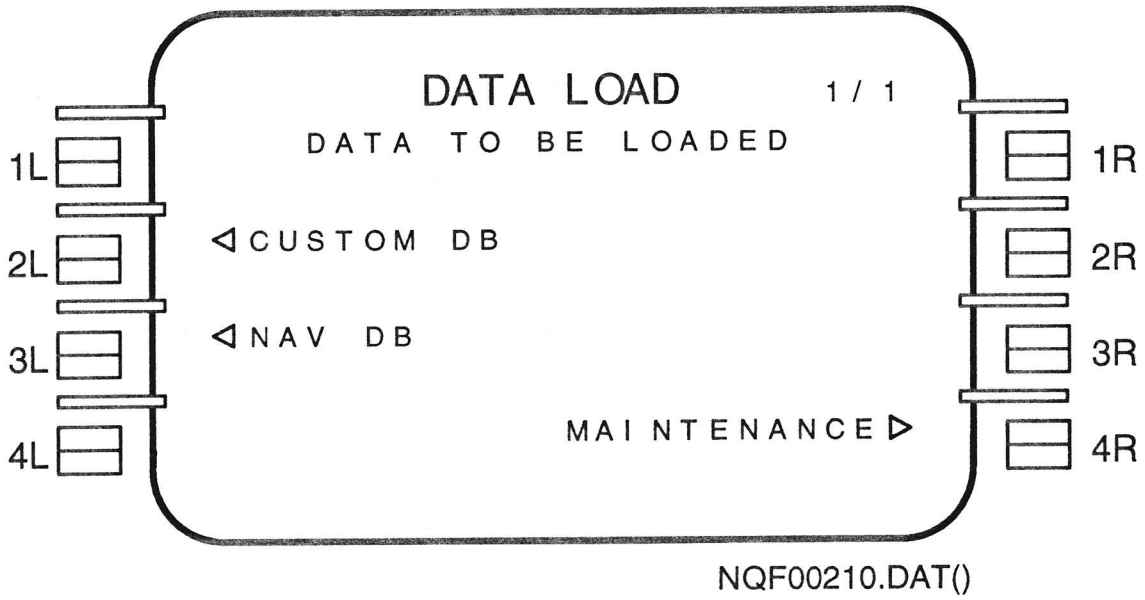


Figure 23

STEP 3 - Select TO LOADER (2R) or FR LOADER (3R) as appropriate (figure 24).

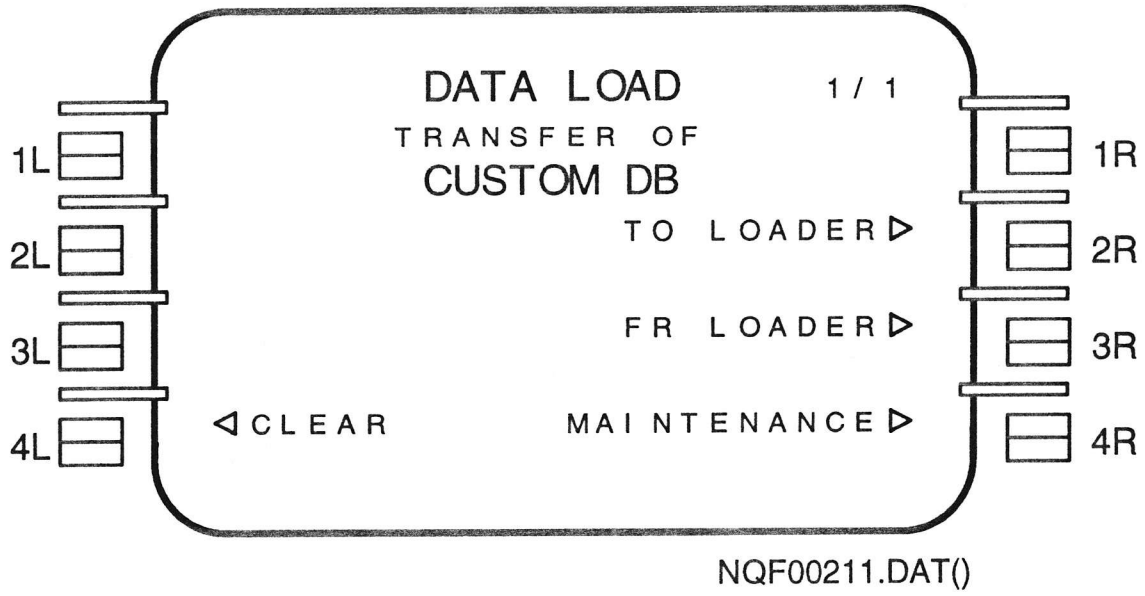


Figure 24

STEP 4 - Confirm selection (figure 25).

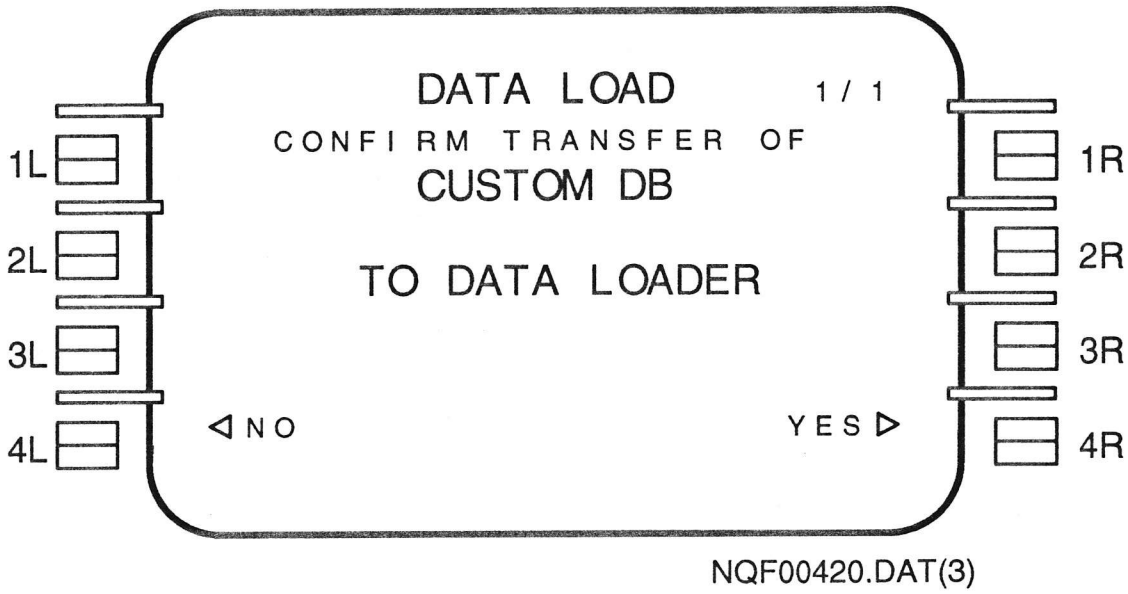


Figure 25

STEP 5 - Monitor progress (figure 26).

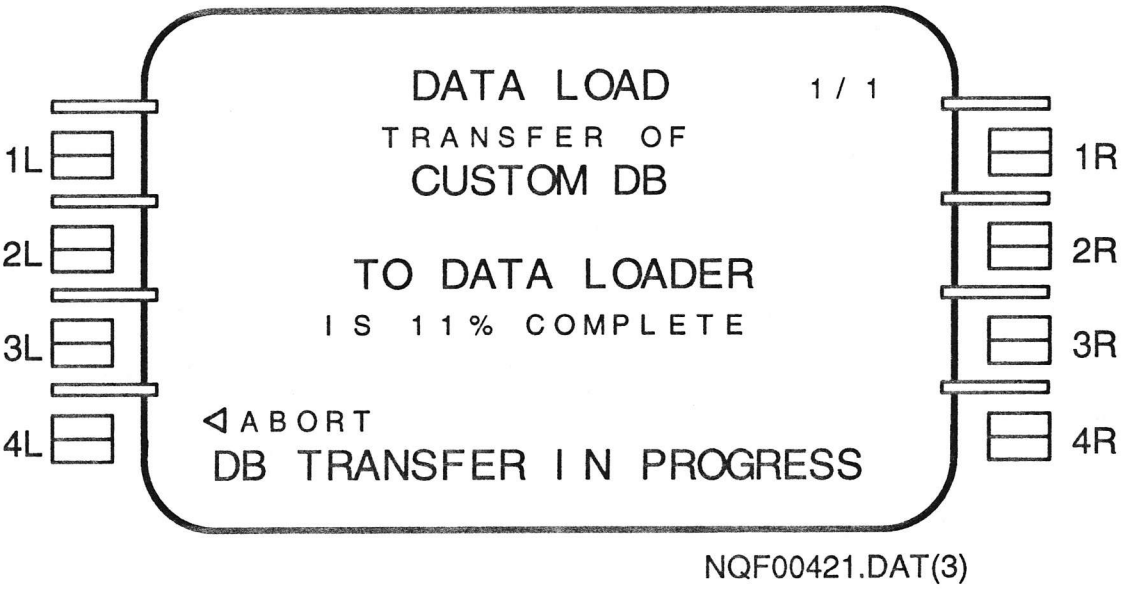


Figure 26

The FMS indicates the percentage complete. When complete, the message DB TRANSFER COMPLETE is displayed. The FMS does a restart in the case where the custom database was loaded from the loader.

If power is interrupted, ABORT selected, or other problems occur that stop loading, the data load process must be repeated from the beginning.

NEW TEMPORARY WAYPOINT TYPES

Additional methods of defining temporary waypoints have been added to the FMS. The new temporary waypoints facilitate easier implementation for specific portions of flight. The temporary waypoints are in addition to those already described in the FMS Pilot's Operating Manual.

- **Runway Extension Waypoints** - The FMS provides a convenient method of creating temporary waypoints on the runway extension line. Once a runway has been activated into the active flight plan, it can be line selected to the scratchpad. When presented in the scratchpad, the runway can be in the format of AIRPORT.RUNWAY/BEARING/. A distance can be inserted to complete the definition of a waypoint on the extension line of the runway. Insert this definition back into the flight plan to create a temporary waypoint. Repeat the process with varying distances to create a number of waypoints on the extension line. If the runway is at the origin, the bearing brought to the scratchpad is the runway heading which allows for waypoints on the departure path. If the runway is at the destination, the bearing brought to the scratchpad is the reciprocal of the runway heading which allows for waypoints on the arrival path.

- **VNAV Offset Waypoints** - ATC sometimes clears an aircraft to cross XX miles before or after a VOR at a specific altitude. This type of clearance can be entered in the FMS using the following procedures. It is accomplished like defining a PLACE/BEARING/DISTANCE (PBD) waypoint without the bearing. In other words, put the "place" (VOR or other waypoint) in the scratchpad. This can be done using the keyboard or by line selecting the place from the flight plan to the scratchpad. Next, enter a "/" indicating the next entry will be a bearing. Since the bearing is not conveniently known for this problem, enter another "/" indicating the next entry will be a distance. Now enter the distance to cross from the "place." Using DRK for the place, the entry would look like DRK//20. Now enter this into the flight plan either before or after the "place." The FMS will automatically place the waypoint on the flight plan at the specified distance. The waypoint name is in the form of *PDXX. The altitude constraint can then be placed at this waypoint.

PERFORMANCE

The performances pages provide for input from the pilot in order for the FMS to calculate the basic flight plan performance data of time and fuel remaining.

PERF INDEX

The PERF INDEX page (see figure 27) is accessible from the "PERF" key on the CDU. Selecting an item from the index displays the pages for the respective function.

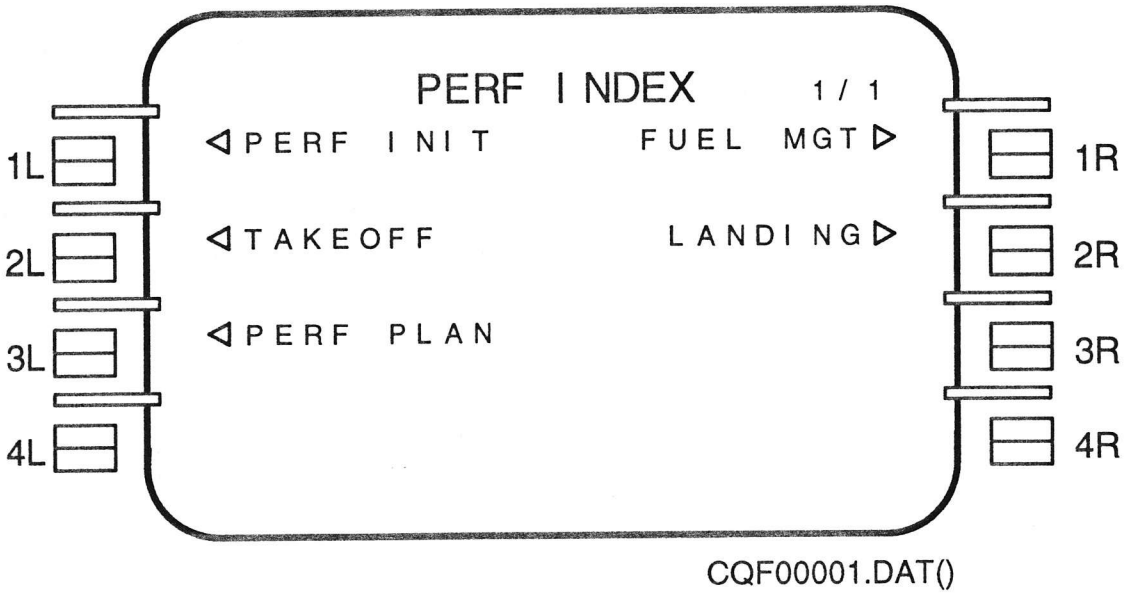


Figure 27

PERF INIT

- **PERF INIT 1/X** (see figure 28) is used to select the method of calculating performance information such as fuel remaining, time to go, and other parameters.

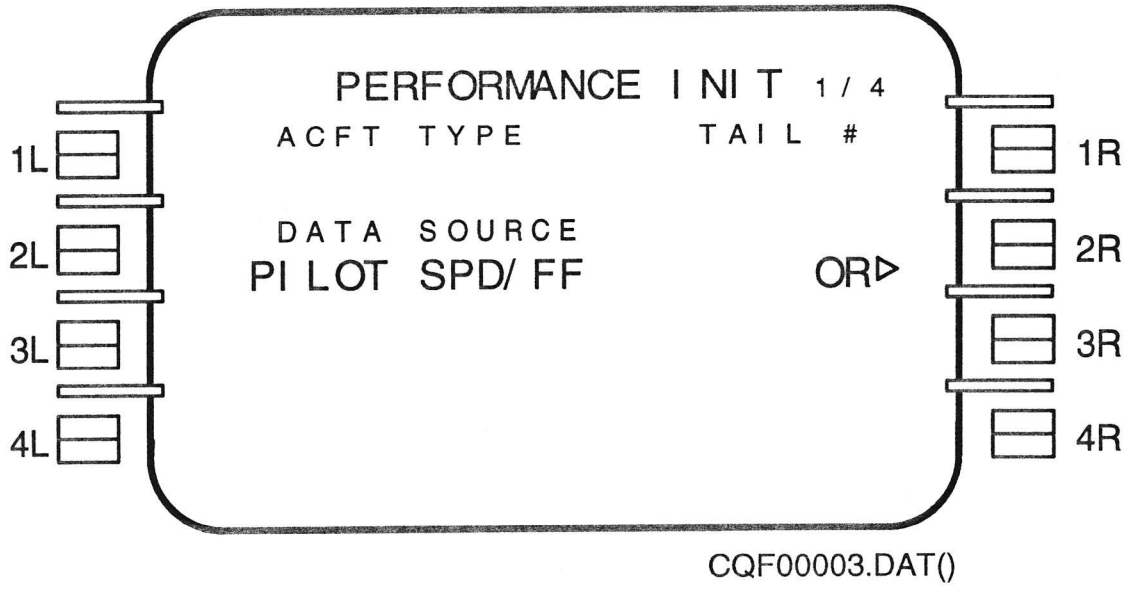


Figure 28

Selecting CURRENT GS/FF results in the FMS calculating time and fuel remaining based on current ground speed and current fuel flow. Selecting this option will cause the ETA/ETE numbers to higher than expected during climb out because of the low ground speed. These numbers will be become more useful at the top of climb when at cruise ground speed. Fuel remaining numbers will be lower than expected during climb out because of the high climb fuel flow. The numbers will be more useful at top of climb when at cruise fuel flow. With the selection of CURRENT GS/FF, PERF INIT is limited to one page.

Selecting PILOT SPD/FF results in the FMS calculating time and fuel remaining base on the values entered on the subsequent PERF INIT pages. See page for a summary of how these performance calculations are done. With this option, there are 4 pages of PERF INIT.

- **PERF INIT 2/4** (figure 29) is used to input the climb, cruise, and descent speed schedules to be used by the FMS. These schedules are used to derived a predicted true airspeed for each phase of flight which when combined with predicted winds yields a ground speed for the calculation of ETA/ETE numbers. This page also allows the entry of a default angle for VNAV and cruise fuel flow. The default angle is used by VNAV when an altitude constraint in entered in the descent portion of the flight plan. The default can be overridden at any specific waypoint by the entry of an angle. The cruise fuel flow is used by the FMS to calculate fuel remaining numbers. The cruise fuel flow is adjusted to predict fuel flow during the climb and descent portion of the flight.

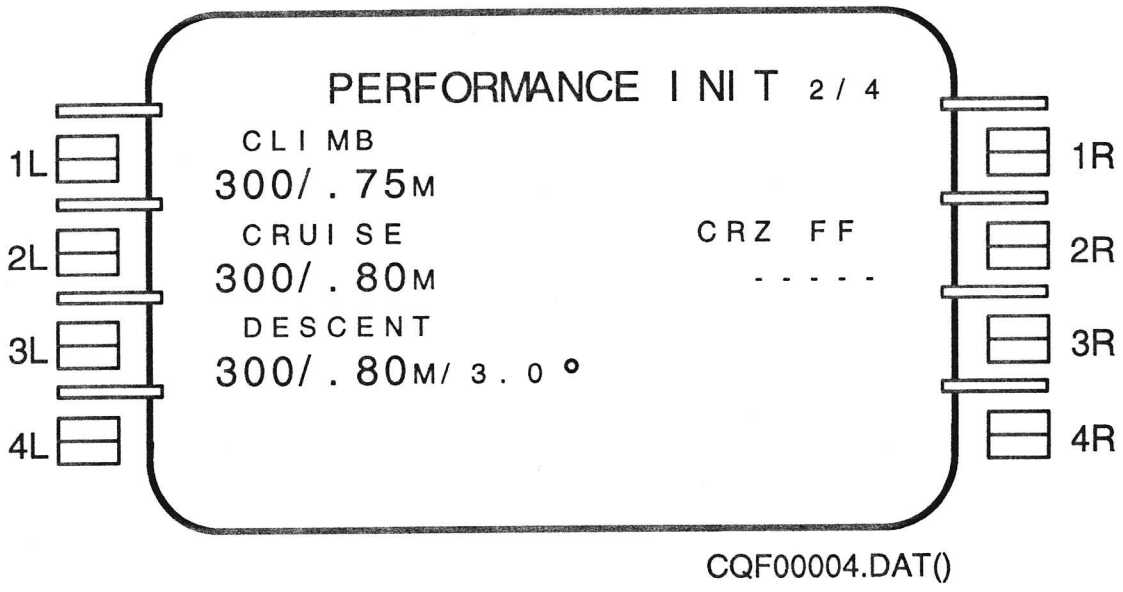


Figure 29

- **PERF INIT 3/4** (figure 30) is used to enter the transition altitude, speed/altitude limit, initial cruise altitude, ISA Dev, and cruise winds. The transition altitude is used by the FMS to determine whether are not to display altitudes in flight levels or feet. The speed/altitude limit is used by the FMS to adjust the speed targets given on the active flight plan page to reflect the limits. The initial cruise altitude is used to allow calculation of top of climb, top of descent, ETA/ETE, and fuel remaining numbers reflecting the cruise altitude. The cruise altitude need not be adjusted if actual cruise altitude is higher. However, it should be adjusted lower if actual cruise altitude is lower. ISA Dev and cruise winds are used by the wind/temperature model to construct a wind/temperature profile at all altitudes (see page PERF PLAN and WIND TEMPERATURE for more detail).

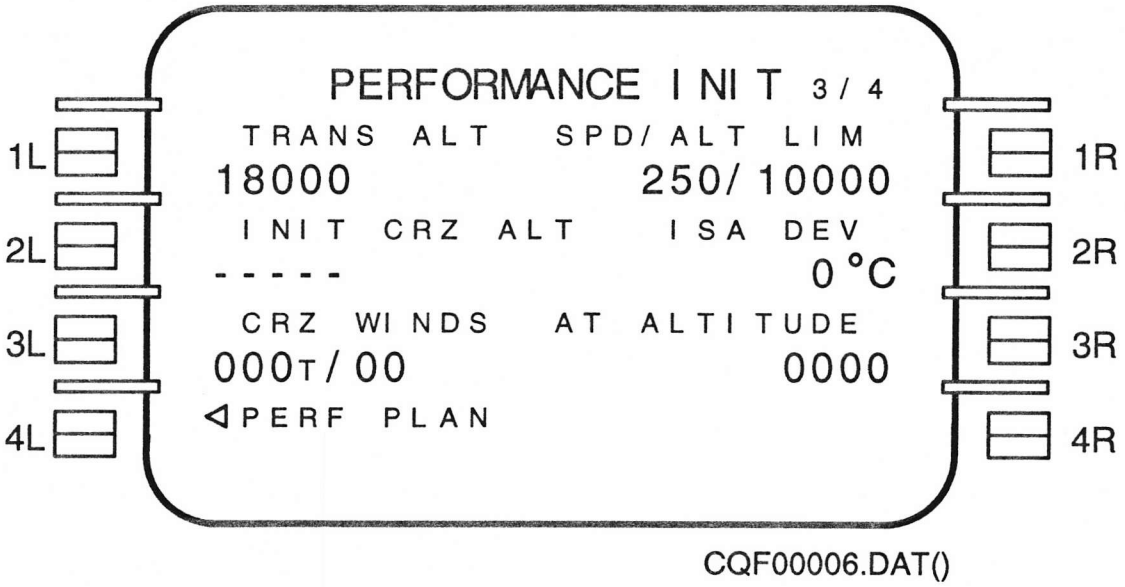


Figure 30

- **PERF INIT 4/4** (figure 31) is used to enter weight information and the calculation of gross weight. The gross weight is continuously updated as fuel is burned off. Note that fuel quality in this system is derived by taking fuel flow and decreasing the pilot entry of fuel quality. Because of this, there may be discrepancies between the fuel quantity of the FMS and that shown on the aircraft fuel gauges.

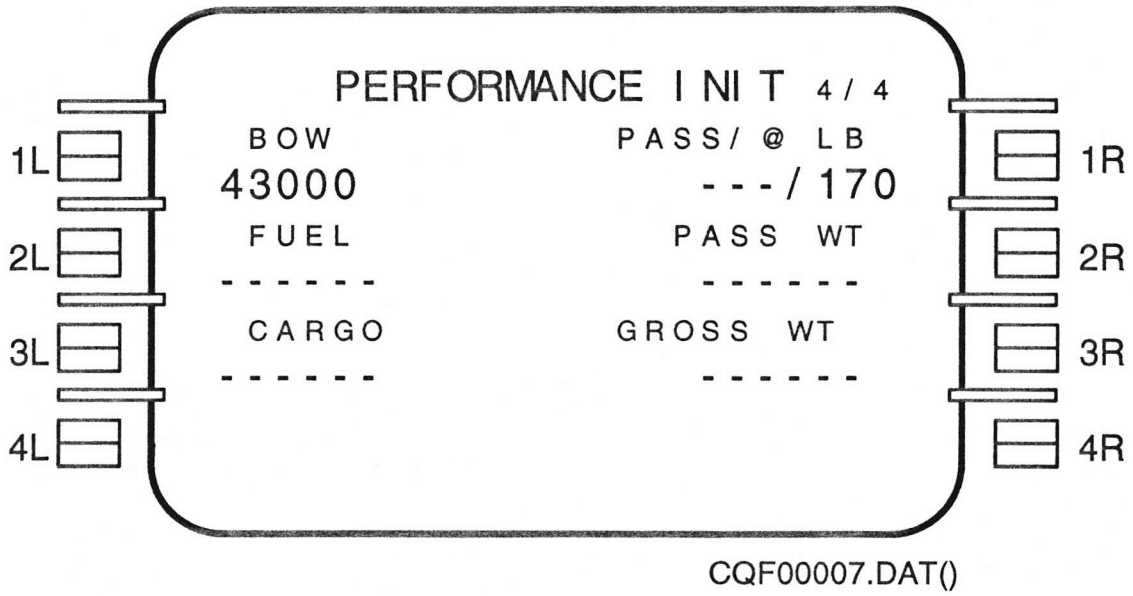


Figure 31

FUEL MANAGEMENT

The fuel management page (figure 32) displays fuel quantity, fuel flow, ground speed, true airspeed, ground specific range, and air specific range. Entry can be made for fuel quantity and fuel flow. An entry of fuel quantity here will be reflected on page 4 of PERF INIT.

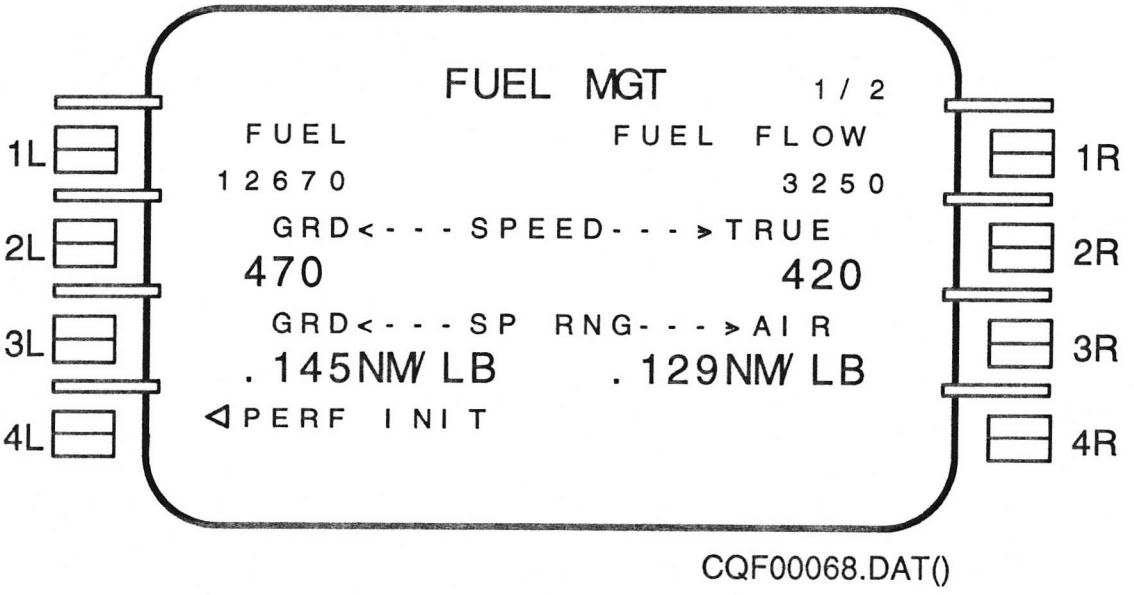


Figure 32

TAKEOFF

There are three pages of takeoff information. This information includes data base information, calculation of wind components, density altitude, and allows pilot entry for display on the CDU only of speeds.

- **TAKEOFF 1/3** (figure 33) displays the runway, runway length, and elevation from the data base. Overriding entries of these items can be made by the pilot. For the calculation of density altitude and wind components, the pilot must enter the outside air temperature in degrees C or degrees F. The wind is entered as the magnetic surface wind. Pressure altitude is calculated from the baro setting and field elevation. If desired, an entry of baro set can be entered in inches of mercury or millibars. If pressure altitude is entered by the pilot, field elevation is calculated using the baro set.

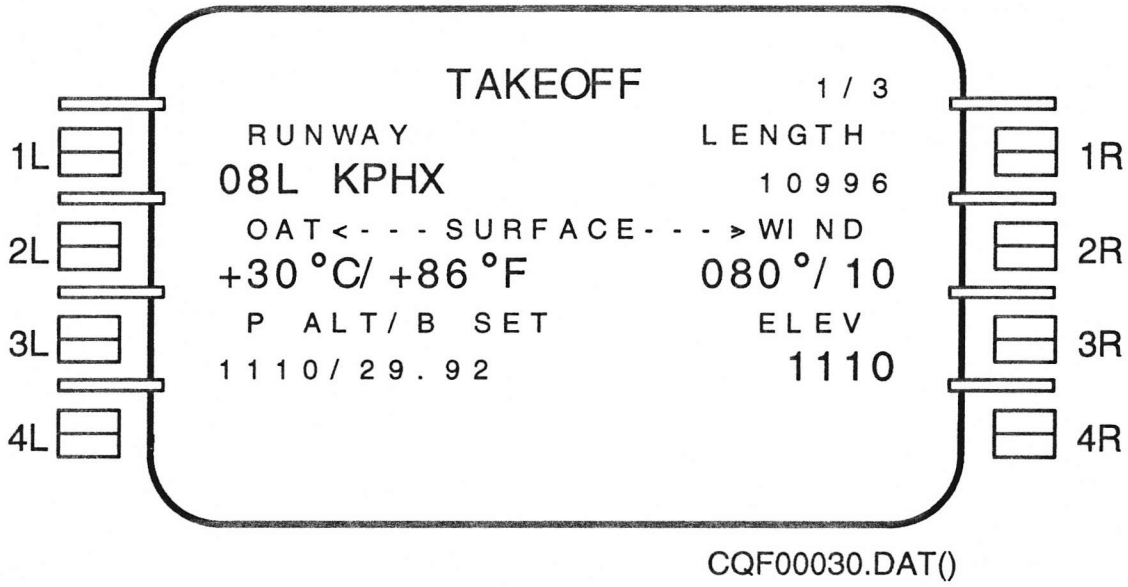


Figure 33

- **TAKEOFF 2/3** (figure 34) displays the runway wind components based on the entered winds from page 1 and the runway heading from the data base or as entered. Also, the calculated density altitude is displayed. No entries are allowed on this page and the information is only used for display on this page.

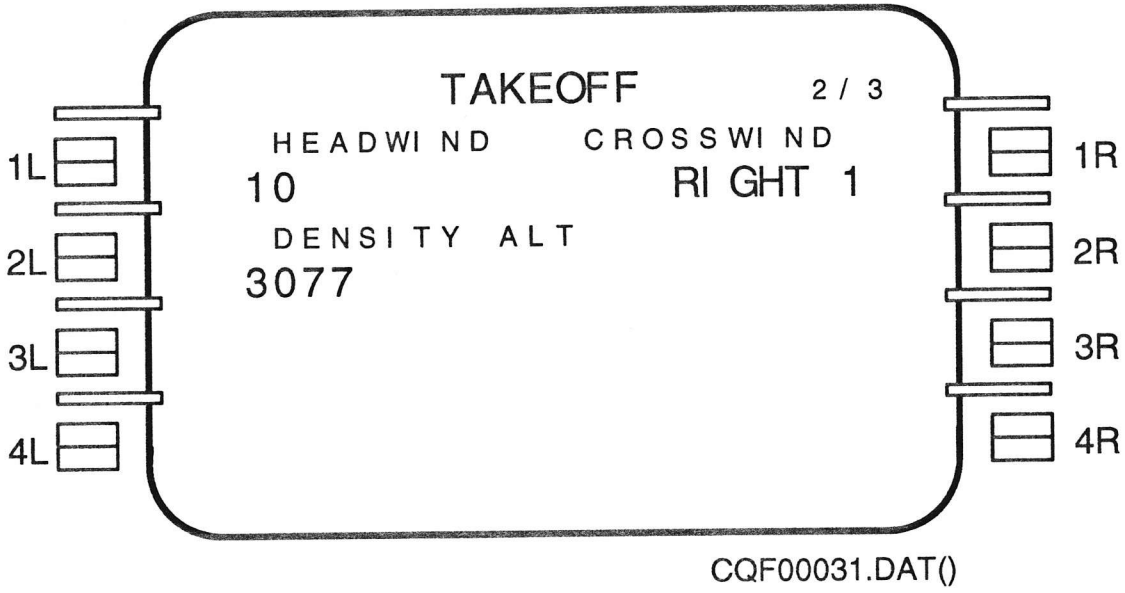


Figure 34

- **TAKEOFF 3/3** (figure 35) allows for entry of takeoff speeds. In order to enter speeds, this page must first be configured through the FMS SETUP page (see figure 9). Once the page is configured, up to six speeds can be entered. The speeds are automatically cleared when the aircraft passes 50 knots above the speed. These speeds are only for display on this page.

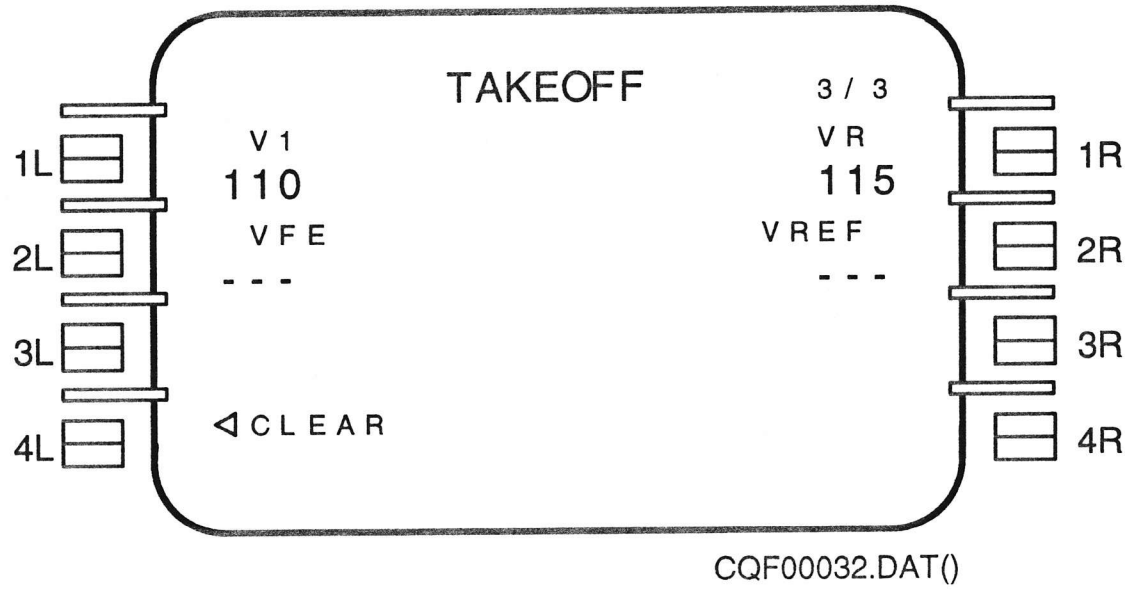


Figure 35

LANDING

There are three pages of landing information. This information includes data base information, calculation of wind components, density altitude, and allows pilot entry for display on the CDU only of speeds.

- **LANDING 1/3** (figure 36) displays the runway, runway length, and elevation from the data base. Overriding entries of these items can be made by the pilot. For the calculation of density altitude and wind components, the pilot must enter the outside air temperature in degrees C or degrees F. The wind is entered as the magnetic surface wind. Pressure altitude is calculated from the baro setting and field elevation. If desired, an entry of baro set can be entered in inches of mercury or millibars. If pressure altitude is entered by the pilot, field elevation is calculated using the baro set.

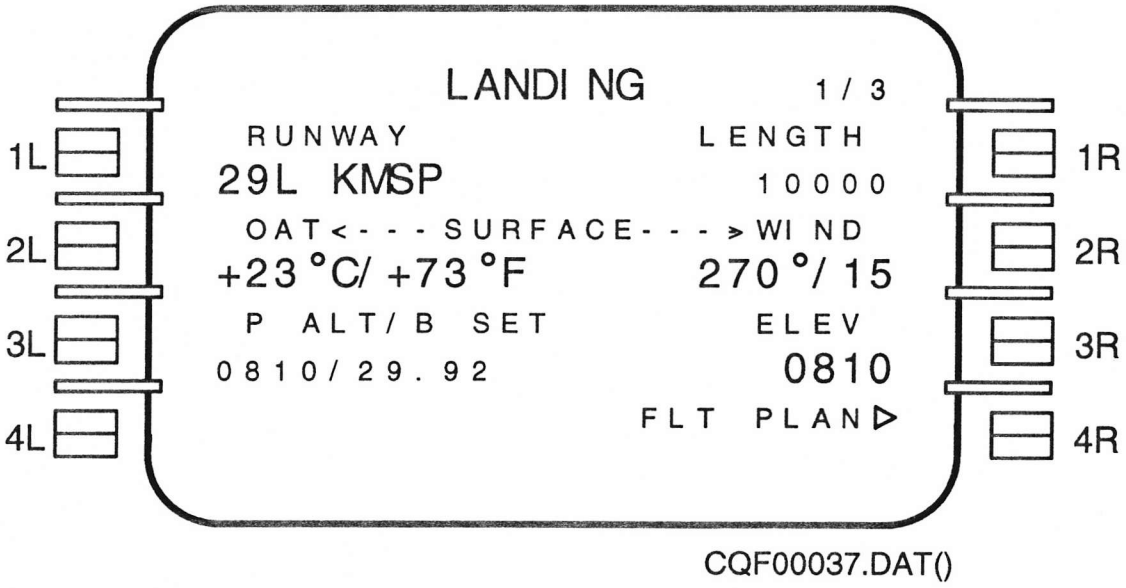


Figure 36

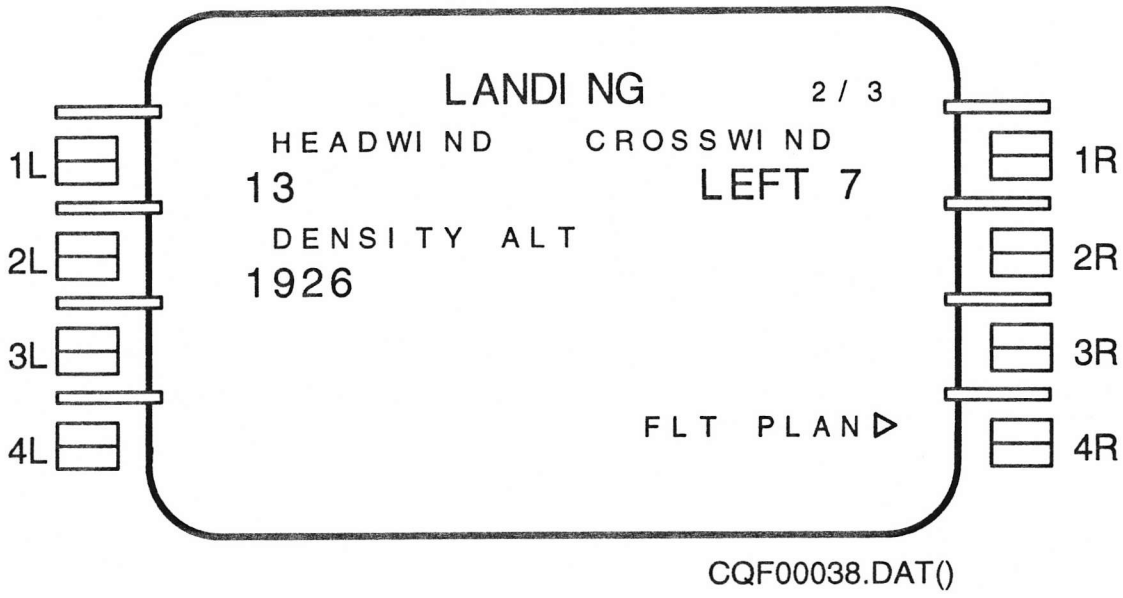


Figure 37

- **LANDING 2/3** (figure 37) displays the runway wind components based on the entered winds from page 1 and the runway heading from the data base or as entered. Also, the calculated density altitude is displayed. No entries are allowed on this page and the information is only used for display on this page.

- **LANDING 3/3** (figure 38) allows for entry of landing speeds. In order to enter speeds, this page must first be configured through the FMS SETUP page (see figure 9). Once the page is configured, up to six speeds can be entered. The speeds are automatically cleared when the aircraft passes 50 knots below the speed or the aircraft lands. These speeds are only for display on this page.

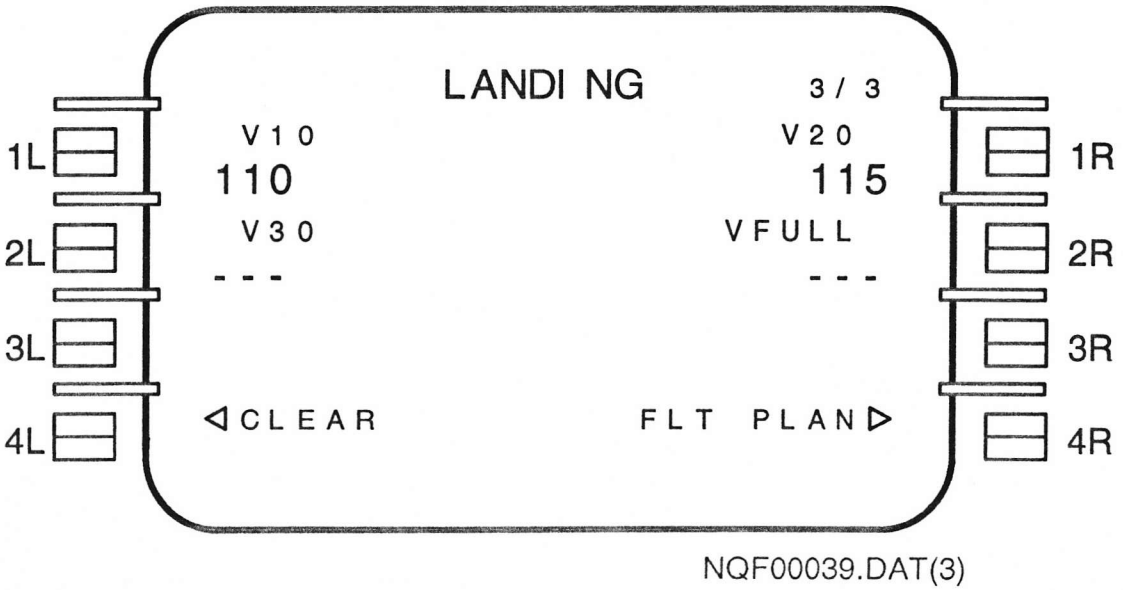


Figure 38

PERF PLAN AND WIND TEMPERATURE

The PERF PLAN pages (figure 39) displays the flight plan with predicted fuel remaining and ETE at each waypoint in the flight plan. In addition, a selection can be made to view and make entries to the wind/temperature model for each waypoint.

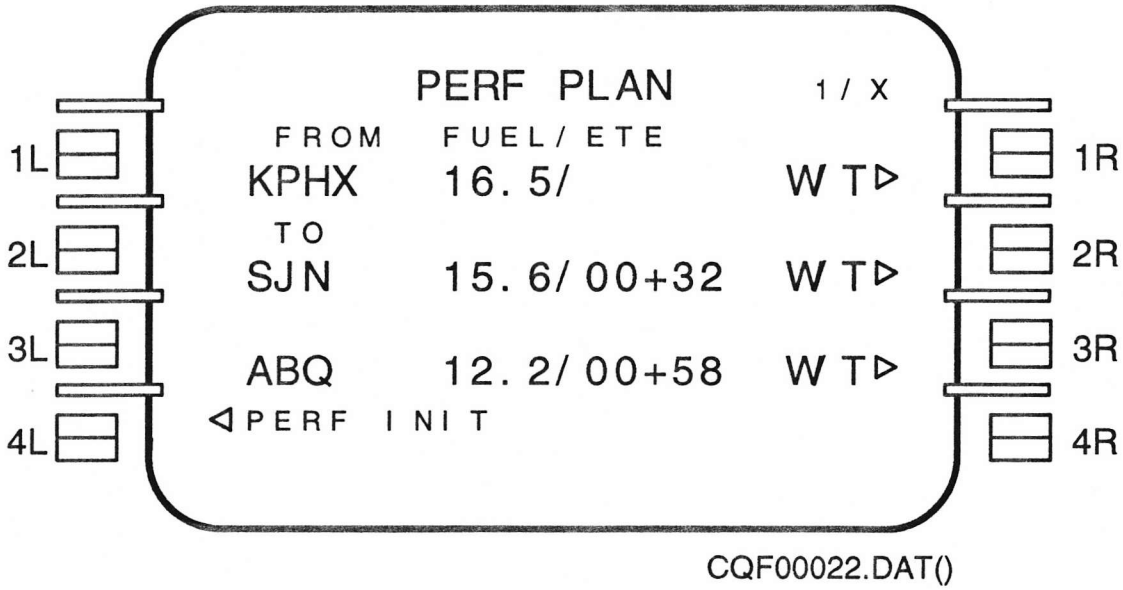


Figure 39

The wind/temperature model (figure 40) is used by the FMS to predict ground speeds along the flight plan in the calculation of ETA/ETE numbers.

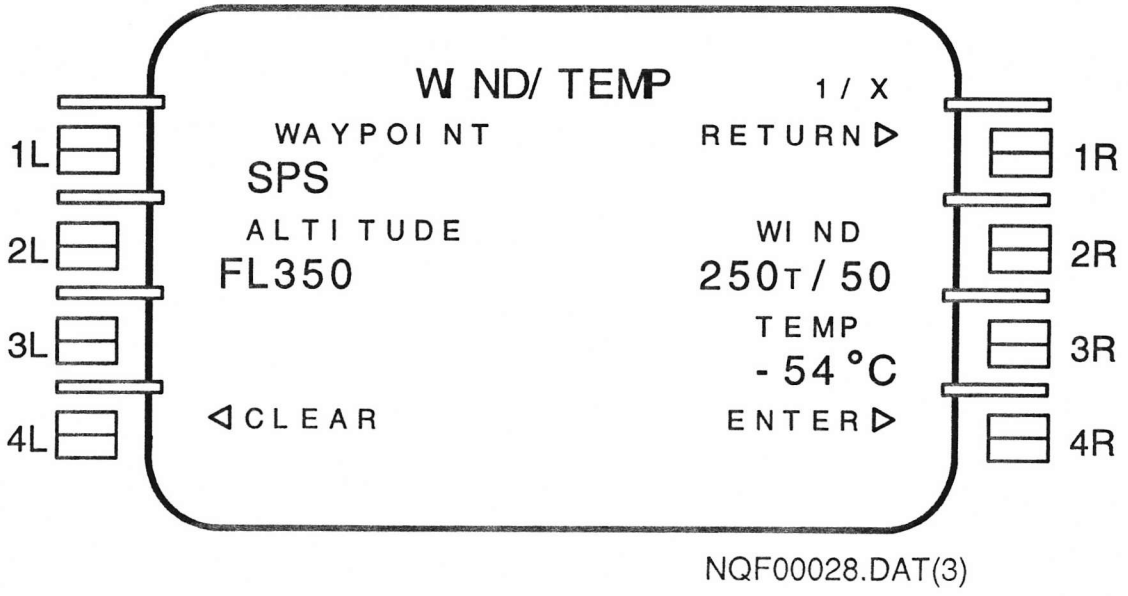


Figure 40

The model combines pilot entries with sensed wind/temperature. Entries are made in two different ways. On PERF INIT page 3, an entry of cruise wind and ISA Dev can be made. This entry is used by the model and applied at each waypoint in the flight plan. Given a wind at a waypoint, the model predicts winds and temperature at any altitude based on standard wind/temperature profiles. The pilot may also make and entry of wind/temperature at any or all waypoints in the flight plan. When a pilot entry is made, it is applied at the point of entry and to all waypoints further along in the flight plan. In addition, once airborne, sensed wind and temperature is blended with entered values to yield the predicted winds and temperature.

By default, the wind/temperature page (figure 40) display the model values at the predicted altitude for the waypoint. The pilot can view the model values at any altitude for any waypoint by making an entry in the altitude line (2L). While on this page, the PREV and NEXT keys can be used to step through the waypoints. Once the pilot has entered both a altitude and a wind or temperature, the enter prompt is displayed as shown at 4R. Selecting the enter prompt inserts the entry into the wind/temperature model.

PERFORMANCE SUMMARY

The FMS provides two options, selected PERF INIT page 1. The options are to have time and fuel calculations based on current conditions of wind, TAS, and fuel flow; or based on planned conditions entered on the PERF INIT pages.

Using the OR prompt at 2R on PERF INIT page 1 allows the selection of CURRENT GS/FF or PILOT SPD/FF. Selecting PILOT SPD/FF causes ETE and fuel remaining to be calculated based on planned numbers from PERF INIT entries. Selecting CURRENT GS/FF causes ETE and fuel remaining to be calculated based on current conditions. The selection is independent on each FMS (in a dual installation) and can be different, even when operating in dual. Both of the options for calculation of time and fuel are discussed below.

The basic elements of time and fuel calculations are distance, ground speed, and fuel flow. Time is calculated by dividing the distance by ground speed. Fuel is calculated by multiplying fuel flow by the time. Using current time and fuel quantity, ETE and fuel remaining can be calculated. These calculations can be done for each leg of the flight plan or for the whole flight plan. The FMS calculates time and fuel for each leg, including the active leg, which are added up for the complete flight plan.

This summary concentrates on what ground speed and fuel flow are used in the calculations. Distance is a product of the flight plan and is the same under all options. Just as a note, the distance shown in the active flight plan is the actual distance to be flown by the aircraft. Because the aircraft flies to the inside of the turn, the distance shown in the flight plan may be shorter than the actual distance between the waypoints. The distance is a function of the course change at both ends of the leg.

PILOT SPD/FF

With PILOT SPD/FF selected, ETE and fuel remaining are calculated using a combination of planned values from PERF INIT entries and sensed values. Values of distance, ground speed, and fuel flow are as follows:

- Distance -- This is the distance of each leg from the active flight plan.

- Ground Speed -- Planned ground speed for each leg is calculated from planned TAS for each leg and wind. The first step in calculating planned TAS is to divide the flight plan into climb, cruise, and descent segments. This is done by calculating TOC and TOD. Next, the PERF INIT entered speed schedules for climb, cruise, and descent are applied to the respective segment to obtain TAS for each leg. Finally, wind is applied to obtain ground speed. Wind used comes the wind model which is a combination of pilot entries and sensed wind.

- Fuel Flow -- The entry of average cruise fuel flow (2R on PERF INIT page 2) is used along with time to calculate fuel remaining. It is adjusted to account for more fuel being used in the climb. Once in cruise, if the actual average cruise fuel flow is expected to be different than the entered value, adjusting the entry will improve fuel remaining predictions.

In summary, this option provides ground speed for each leg based on PERF INIT entered speed schedules and a combination of entered wind and sensed wind adjusted for altitude. Fuel flow is either entered cruise fuel flow adjusted for climb or unadjusted current fuel flow.

CURRENT GS/FF

With CURRENT GS/FF selected, ETE and fuel remaining are calculated using current conditions. Current conditions of distance, ground speed, and fuel flow are as follows:

- Distance -- This is the distance of each leg from the active flight plan.

- Ground Speed -- Ground speed for each leg is calculated from current TAS (displayed on the top line of the AIR DATA page), and current wind (displayed on PROGRESS page 3/3 at 3L). This allows the FMS to apply the wind to each leg. As a function of course, wind can cause the ground speed for each leg to be different.

- Fuel Flow -- Current fuel flow (displayed on the FUEL MGT page 1/2 at 2L) is used to calculate fuel for each leg. Normally, this fuel flow value is sensed fuel flow, but can be overridden with an entry. In any case, the value displayed on the FUEL MGT page is the value used in the calculation of fuel remaining.

CONCLUSION

There are advantages to both ways of calculating performance. With CURRENT GS/FF, ETE and fuel remaining are calculated using current conditions. This has the advantage of being very straight forward and easy to cross check against current ground speed and fuel flow. The disadvantage is that it is not very accurate during ground operations, climb out, or throttle adjustments.

With PILOT SPD/FF, calculations are made using planned values. This has the advantage of being more accurate during all operations assuming you fly close to the plan. Because it is based on the plan, cross checking is not as direct using this method.

SECTION IV - EMERGENCY PROCEDURES

No Change.

SECTION V - PROCEDURES FOLLOWING FAILURE

Should a system or sub-system component fail, in most cases the CRT will go blank or the MSG light will illuminate. The failed unit will be indicated on the maintenance page.

SECTION VI - PERFORMANCE

No Change.